Technical Report 692

An Empirically Derived Taxonomy of Organizational Systems

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U. S. Army
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An empirically derived taxonomy of organizational variables was developed using organizational psychology and systems theory topics as inputs. A list of 84 variables was selected as input. The taxonomy was generated empirically by classifying each of over 200 organizational/systems theoretic articles according to a checklist format regarding the extent to which each document addressed various topic areas of interest to the effort. A factor analysis model was applied to the document classifications in order to generate a candidate group

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of factors upon which to base a taxonomy. Various factor reliability indexes were computed and a final solution that involved the establishment of six primary factors was reached. These six factors served as basic taxonomic categories. They are as follows: multidimensional information processing, organizational systems dynamics, organizational change technologies, management authority/compliance characteristics, organizational coordination and control, and goal orientation.

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FOREWORD

One of the goals of the Leadership and Management Technical Area of the Army Research Institute for the Behavioral and Social Sciences is to provide the Army with tools and procedures for improved management and leadership. This report describes the development of an empirically derived taxonomy of organizational variables. The taxonomy was generated by rating over 200 journal articles according to the extent their authors emphasized 84 organizational variables. The results of this report, in part, formed an important basis for the development of a prototype computer-based simulation for the assessment of the complex decision-making skills required of senior Army leaders. This report is likely to be of interest to researchers and others concerned with organizational processes, leadership, and climate.

EDGAR M. JOHNSON
Technical Director

AN EMPIRICALLY DERIVED TAXONOMY OF ORGANIZATIONAL SYSTEMS

EXECUTIVE SUMMARY

Requirement:

Developing organizational taxonomies has been of interest to organizational psychologists and sociologists for some time. However, a majority of the organizational taxonomies to date have been derived from "common sense" or theoretical approaches rather than from an empirically derived perspective. The traditional and theoretical approaches to taxonomy development are limited in their perspective to a particular theoretical position or intuitive philosophy. A need exists for empirically derived taxonomies (i.e., taxonomies that are theoretically based but verified by data). The specific need addressed in this study was for an empirically derived taxonomy of organizational and systems theoretic variables to be used as an organizing framework for a subsequent literature review.

Procedure:

From a review of major textbook indexes and topical headings in management, organizational psychology, and systems theory books, some 350 conceptual terms were generated. A consensus was reached regarding a selected list of 84 terms from the original list. These terms were placed in a checklist article evaluation form to serve as a basis for rating articles with regard to their treatment of each selected variable. The purpose of the rating was to determine the extent to which each article discussed or otherwise treated each of the variables. An interrater reliability pilot study was conducted with five randomly selected articles to determine the feasibility of having individual raters rate groups of articles rather than requiring all raters to rate all articles. A second pilot study factor analyzed data from the rating of 240 randomly selected articles to determine the feasibility of a factor analytically based approach to taxonomy development. A final factor analysis was then conducted using data from a separate sample of over 200 randomly selected articles. This analysis was used to develop and operationally define the taxonomy of organizational variables.

Findings:

1. The interrater reliability study yielded reliability coefficients for single ratings ranging from .45 to .70, thus indicating the feasibility of using individual raters to rate selected groups of articles.

2. A pilot factor analysis indicated the feasibility of this approach to taxonomy development and produced a factor solution which, after plotting eigenvalues in the Scree Test format, resulted in a leveling off of factor variance between 7 and 8 factors.

3. A final factor analysis produced a clearly defined factor structure consisting of six relatively stable independent factors. These factors were generally consistent with the composition of those factors extracted from the pilot study. The factors included (1) multidimensional information processing, (2) organizational systems dynamics, (3) organizational change technologies, (4) management authority/ compliance characteristics, (5) organizational coordination and control, and (6) goal orientation.

Utilization of Findings:

The taxonomy produced by this procedure served as the organizing model for a subsequent review of the organizational and systems theoretic literature (Swezey, Davis, Baudhuin, Streufert, & Evans, 1980). The empirical taxonomy technique reported herein is also intended for use in other Army Research Institute (ARI) projects where organizational variables must be ordered to review literature and/or to provide a model for determining research needs.

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SECTION 1.0. INTRODUCTION: THEORETICAL AND EMPIRICAL APPROACHES TO ORGANIZATIONAL TAXONOMY DEVELOPMENT

PURPOSE

The research reported in this document addresses four primary objectives: (1) to review the available literature relative to the development of theoretically and empirically based organizational taxonomies; (2) to select, from a wide range of organizational psychology and general systems theory research, those variables thought to be most representative of the overall objective for this research project; (3) to select an empirical method and statistical model for developing a taxonomy of organizational variables; and, (4) to develop an empirically derived taxonomy of organizational variables grounded in the systems theoretic perspective to guide in the literature review and design of the test bed.

THE NATURE OF THE PROBLEM

Developing comprehensive organizational taxonomies has been of interest to organizational psychologists and industrial sociologists for some time. Warriner (1980, pp. 1-3) identified three major classification

procedures that have been utilized in organizational research: (1) the "traditional, folk, or common sense classification; ... (2) the theoretical, a priori, or heuristic; ... and (3) empirical taxonomies." Traditional classification systems are frequently used, but have some basic limitations which have been summarized by Warriner, who observed that "such classifications do not define the content of the classes, do not show the relationship of the several classes to each other, and do not give us reproducible categories" (p. 2). This intuitive "common sense" approach to organization classification is, quite simply, bound by the limitations, the biases, and/or the organizational frames of reference of those doing the classification. Theoretical or heuristic taxonomic systems are usually based on a theory of interest to the individual developing the taxonomy. The theory, then, drives the selection of one or several dimensions related to that theory. These few dimensions and their variations thus serve as a basis for the classification system. According to Warriner "these classifications have utility primarily for those who are using the particular theory on which the classification is based.... Theoretical taxonomies depend upon the adequacy of the theory... If the theory is weak ... then the classification will have little value" (pp. 3-4). A majority of the taxonomies which have been developed over the years are of the "theoretical" or "heuristic" variety. Like the "common sense" taxonomies, the limitations of theoretical taxonomic procedures are that they are single theory-bound and idiosyncratic to the person doing the classification or to the theory under consideration.

The categories follow from the theory. In the third procedure, empirical taxonomy, an array of units (organizations) to be categorized are described relative to a large number of characters (variables), and then sorted in accordance with their affinity or similarity across the variable set. According to Warriner, "empirical taxonomies, in contrast to theoretical ones, have a high information content (i.e., they describe many features of the organizations in a given class), but they do not account for that ordering. In addition, the adequacy of such classifications depends upon (1) the range of representativeness of the cases used in the analysis, and (2) the range and number of characters used to describe the cases" (p. 4). The major limitations of this procedure are related to limits of representativeness reflected in the cases (organizations) used for analysis and in the limitations regarding the diversity and number of variables used for the empirical taxonomy. Both of these limitations can be overcome as computer technology and capability increase. Empirical taxonomies are derived from data rather than from a theory.

It was not until recently that social scientists have expressed a dedicated research interest in the development of empirically derived classification systems. McKelvey (1975a) provides a review of multivariate approaches to empirical taxonomy development along with a series of guidelines for future empirically derived taxonomies. His review and set of guidelines to some extent clarify the nature of the problem addressed in this report. The underlying objective

of McKelvey's approach is parsimony of classification. This objective is difficult to achieve with the potentially large number of important organizational characteristics which have been identified in existing studies (Sells, 1964, 500 variables; Haas, Hall, & Johnson, 1966, 210 variables; and Pugh, Hickson, Hinings, & Turner, 1963, 64 variables). However, McKelvey cautions that parsimony has a price--oversimplification at the expense of scientific utility. Given the large number of potential variables, the multivariate approaches along with multivariate statistical models are recommended as an effective way of reducing a large set of complex variables and relationships to a smaller, more meaningful array of organizational attributes. In addition to the multivariate approach, McKelvey calls for taxonomy developments that are independent of existing organizational classifications. While this represents the ideal, most of the studies that were reviewed in this report and those studies matched against McKelvey's guidelines did not meet this requirement.

McKelvey's guidelines were:

"Guideline 1: Define the broadest possible population of organizations or, if a delimitation is unavoidable, base it on a significant cultural unit (p. 512)."

In practical terms this guideline suggests that the organizational analyst clearly outlines the scope of the organizations from which a taxonomy is to be developed. Ideally, the definition should be as

broad as possible. Practically, some delimitations are necessary because of the diversity of organizational types available from a broadly defined organizational population.

"Guideline 2: Use a probability sampling plan without any stratification for selecting a sample of organizations" (p. 513).

This guideline calls for a plan which allows for all members of the population having an equal probability of being used in the taxonomy development. For practical and theoretical reasons this guideline is difficult to achieve.

"Guideline 3: Define as inclusive a population of organizational attributes as is possible (p. 514)."

It is nearly impossible to use perfectly "raw data" in developing taxonomies. Previous research is bound to play some role in the selection of characteristics for taxonomic development. Therefore it is recommended by McKelvey that the population of attributes be defined to include virtually all existing organizational characteristics.

"Guideline 4: Use a probability sampling plan for selecting a sample of organizational attributes" (p. 516).

This guideline proposes utilization of a plan which allows for each organizational characteristic or variable to have an equal chance of appearing in the "sample" of attributes serving as the baseline for the taxonomic development. This is simply a way of reducing the large population of organizational attributes to a

smaller set of variables so that both the organizational scientist and the multivariate analysis models can manage the taxonomic development.

"Guideline 5: Define the population of observers of organizational attributes to be as inclusive as possible.

Guideline 6: Use a stratified probability sampling plan for selecting observers" (p. 516).

These guidelines place the choice of observers (in our case, judges and authors) into the same "representativeness" and "probability" perspective suggested in the previous guidelines. These guidelines suggest that as many reviews of organizations and organizational attributes, as many theoretic derivations, as possible be included in the taxonomic development.

"Guideline 7: The sample of attributes must be no larger than the input capacity of the multivariate analysis program or else an iterative procedure of analyses based on randomly selected overlapping subsets of the sample should be used" (p. 517).

Despite rapid advances in computer technology and multivariate computer programs there are still limitations imposed on the size of the data base that can be handled by these multivariate analyses. Therefore, an iterative analytical approach which treats overlapping subsets of the attribute population is recommended.

"Guideline 8: Each attribute must not be overrepresented

in the input stream of the multivariate program and must be independently measured" (p. 518).

Prior classifications should not influence empirical analyses. It is assumed that each attribute has an equal chance of serving as a taxonomic concept in the resulting classification. Additionally, this guideline assumes that each organizational characteristic is theoretically defined independently of all other characters in the attribute population. This guideline basically suggests that each attribute should be, to the extent possible, equally representative of the population from which it is selected.

"Guideline 9: Criteria guiding unavoidable decisions in using analysis must be publicly described and consistently applied" (p. 519).

This guideline simply reiterates a sound scientific principle that all rules relative to the research exercise should be specified beforehand. Where there is any room for interpretation, for example in the many factor analytic procedures currently available to organizational analysts, the criteria utilized for making analytical or statistical decisions should be openly discussed by the organizational scientists.

"Guideline 10: Classificatory breaks in ordering type concepts should come at points optimizing parsimony and intraclass homogeneity" (p. 521).

Taxonomic development should attempt to reduce large, complex

attribute populations into smaller, more meaningful homogeneous attribute dimensions. This is the aim of multivariate programs such as factor analysis and numerical taxonomy. The basic question underlying this guideline is: to what extent can a complex set of diverse organizational dimensions be described by fewer, more inclusive homogeneous factors? Carper and Snizek (1980a and 1980b) have reviewed nearly 20 classification systems for the expressed purpose of synthesizing these systems into a clear and effective taxonomic schemata. Carper and Snizek proposed an evaluation schema for existing taxonomy studies which used as criteria axioms presented by Sokal and Sneath (1963) in their pioneering work on numerical taxonomy.

Although the fact that numerical taxonomy was primarily a product of biology and mathematics, the axioms presented by Sokal and Sneath illustrate the standard requirements for any practical taxonomic system. The axioms also provide guidelines for research efforts and suggest the nature of the problems associated with taxonomic development. According to Sokal and Sneath, the "ideal" taxonomic system must be developed in concert with the following axioms:

A1. The ideal taxonomy is that in which the taxa have the greatest content of information and which is based on as many characters as possible.

A2. A priori, every character is of equal weight in creating natural taxa.

A3. Overall similarity (or affinity) between any two entities

is a function of the similarity of the many characters on which they are being compared.

A4. Distinct taxa can be constructed because of diverse character correlations in the groups under study.

A5. Taxonomy as conceived by us is, therefore, a strictly empirical science.

A6. Affinity is estimated independently of phylogenetic i.e., evolutionary considerations (1963, p. 50).

The first axiom suggests a concept familiar to behavioral scientists, the multidimensional approach. Because there currently is no existing organizational taxonomy accepted by organizational theorists, this axiom suggests that researchers must utilize as many variables as possible in their investigations. Closely related to the first axiom, axiom 2 indicates that researchers should avoid making any a priori choices relative to which variables to include and exclude, or whether those variables included should be differentially weighted. This axiom is very similar to the concept of randomness; i.e., the validity of an organizational taxonomy across all organizational domains would require that each variable have an equal probability of being used in developing that taxonomy. The third axiom suggests that the amount of similarity (affinity) between any two variables (characters) will be a function of the similarity of variables within the total variable set. For the organizational analyst, the logic underlying this axiom suggests that as the diver-

sity of characters in the variable set increases, i.e., less overall affinity among the variable set, the degree of similarity between any two variables will decrease. Conceptually, the fourth axiom is the baseline for empirical taxonomic methodologies. In the words of Sokal and Sneath (1963) "classification in numerical taxonomy is based on a matrix of resemblances, and it consists of various techniques designed to disclose and summarize the structure of the matrix" (p. 52). Familiar multivariate techniques such as correlation analysis, factor analysis, and multidimensional scaling are used for conducting matrix analysis. The fifth axiom expresses the view that taxonomy development should be empirically driven. The final axiom cautions researchers relative to making a priori decisions regarding the importance of variables to be considered in a taxonomy based on previous research. The state of existing organizational taxonomy research reveals that this axiom has proven virtually impossible to satisfy. Accordingly, generalizations from existing research to more diverse organizational populations is difficult and must be made with extreme caution.

Carper and Snizek (1980b) summarize the extent to which selected authors have conformed to these axioms in Table 1.

In sum, theoretical and empirical approaches to organizational taxonomy development share problems common to virtually all of the social and behavioral science disciplines. The concern expressed recently by organizational taxonomists (Warriner, 1980; McKelvey, 1975; and Carper & Snizek, 1980a and 1980b) seem to focus on very traditional social science research issues such as control,

Table 1

Presence of Sokal and Sneath's "Ideal" Taxonomic Axioms in the Works of Selected Organizational Theorists [a]

Author and date	Taxonomic Axioms A1: Use of a multi-dimensional approach	A2: Every character has equal weight	A3: Overall similarity between entities	A4: Use of matrix analyses	A5: Taxonomy is an empirical science	A6: No a priori assumptions concerning importance
Aaker (1971)				*	*	
Goronzy (1969)				*	*	
Haas, Hall, and Johnson (1966)	*			*	*	
Hage (1965)	*					
Hall (1972)	*		*	*	*	
Johnson (1963)					*	
March and Simon (1958)	*				*	
McKelvey (1975)	*	*			*	*
Perrow (1970)	*					
Pugh, Hickson and Hinings (1969)	*		*	*	*	
Pugh, Hickson, Hinings, and Turner (1968)	*		*	*	*	
Samuel and Mannheim (1970)	*	*				

*Indicates the axiom or a similar proposition was cited by the author(s).

[a] Extracted from Carper and Snizek (1980b, p. 2).

random sampling procedures, representativeness of research variables, equivalence and independence of variables, theoretical biases stemming from previous research findings, the objectivity of experimenters and organizational scientists conducting the study, and the degree to which empirical taxonomic findings are generalizable and/or descriptive across real organizations. Despite these concerns, the development of organizational taxonomies remains a fundamental element in the evolution of organizational theory. The problems associated with "common sense" and "theoretical" taxonomies, i.e., taxonomies have been developed by individual organizational theorists which include only a few characters thought important to that theorist, has led to the development of empirically derived taxonomies.

DEFINITIONS OF ORGANIZATIONAL TAXONOMIES

Taxonomic development in organizational theory is at a relatively young stage. There is little agreement among organizational scientists about terminology let alone concurrence on theories or methodologies of classification. Haas, Hall, and Johnson (1966) defined "taxonomy" by suggesting that,

> "a ... taxonomy of organizations ... must reflect the characteristics which can, in fact, be found among the myriad of organizations which can be examined. In other words ... let the data indicate which variables tend to 'hang together' in the world of organizational phenomena as we can observe and record it" (p. 161).

Taxonomy development, according to this definition, is empirical, multivariate, and inductive. The term "typology" is reserved for

intuitive or deductive approaches. Despite theoretical disagreements among organizational scientists, determining what and how variables "hang together" has been a central operational theme in virtually all of the "empirical" definitions of taxonomy that were reviewed.

According to Sells (1964):

> "a ... taxonomy should be a theoretical model which orders empirical observations ... based on the developed network of relationships. In its fullest development *the taxonomic approach should conform to the* general systems approach;" (p. 515).

Sells thus adds the concept of "ordering" of variables or characteristics as derived from multivariate analytical approaches which examine the "network of relationships." Sells argues that the taxonomist and general systems theorist must work together because they belong to disciplines that are compatible with respect to organizational taxonomy development.

Pugh, Hickson, and Hining (1969) characterize the term "taxonomy" as a "classification ... based upon dimensions that are measurable and empirically established .... A taxonomy is thus a multidimensional classification" (p. 115). This definition adds the concept of "measurability" of variables through observations in "real world" organizational settings.

For our purposes, "taxonomy" is operationally defined as:

> An empirical, multivariate process which examines the relationships and the degree of similarity and difference among organizational variables by systematically measuring the affinity of characters in the set and ordering these variables in some hierarchical fashion permitting a more parsimonious description of organizations.

APPROACHES TO ORGANIZATIONAL TAXONOMY DEVELOPMENT

In our discussion of the nature of the problem three general approaches to organizational taxonomy development were outlined: the common sense, the theoretical or heuristic and the empirical approach. Two of these approaches were considered in greater detail as candidates for the present study. The first approach considered, the theoretical or heuristic, was discarded for a variety of reasons including the fact that the ways organizational taxonomies are derived from this perspective are as different as those doing the classification. The theoretician identifies a dimension or two and then finds ways of supporting that philosophical position. Closely related to this problem, virtually all of the theoretical typologies are constructed around one or two major organizational variables. Carper and Snizek (1980b) observe that "given that organizations are complex entities, the use of undimensional typologies with multidimensional objects fails to pass even the most elementary test of logic and results in categorizations that are so general that they are hardly more than tautologies having little or no practical significance" (p. 70). Carper and Snizek summarize the theoretical approaches to taxonomy development in tabular form. Table 2 depicts that summary.

The second approach, empirical, was selected for the present study for several reasons. First, we viewed military organizations

Table 2

A Summary of the Most Frequently Cited Works Using Theoretically Constructed Typologies or Taxonomies [a]

Author (Date)	Organization Studied	Criterion Variables	No. of Types	Typologies Specified
Weber (1947)	Social and economic	Rationality	1	Bureaucracy as an ideal type
Woodward (1958, 1965)	British industrial firms	Production technology	3	1. Unit/small batch 2. Large batch/mass 3. Continuous Process
Gordon and Babchuk (1959)	Voluntary associations	Accessibility of membership; status-defining capacity; the function of the assoc. for the members	12	The only typology of voluntary associations reported to date.
Parsons (1956, 1960)		The goals or functions of the organization	4	1. Economic 2. Political 3. Integrative 4. Pattern maintenance
Burns and Stalker (1961)	Industrial firms in Great Britain	Patterns of adaption to technological & commercial change	2	1. Mechanistic 2. Organic
Etzioni (1961, 1975)		Compliance relationship	3	1. Coercive 2. Utilitarian 3. Normative
Blau and Scott (1962)		Who benefits	4	1. Mutual benefit 2. Business concerns 3. Service organizations 4. Commonwealth organizations
Emery and Trist (1965)	A British canning firm and farmer's union	Environments	4	1. Placid random 2. Placid clustered 3. Disturbed reactive 4. Turbulent fields
Katz and Kahn (1966)		Genotypic functions and second-order factors	4	1. Productive 2. Maintenance 3. Adaptive 4. Managerial or political Cf. Parsons (1956, 1960)
Van Ripper (1966)		The amount of power those at the top of an organization have over those below	6	1. Control organizations 2. Production organizations 3. Bargaining organizations 4. Representative organizations 5. Research organizations 6. Communal organizations Cf. Etzioni (1961, 1975)
Perrow (1967, 1970)		Technology, number of exceptional cases, and type of search process	4	1. Craft 2. Routine 3. Nonroutine 4. Engineering Cf. Woodward (1958, 1965)
Thompson (1967)		Core technologies	3	1. Long-linked 2. Mediating 3. Intensive Cf. Woodward (1958, 1965) & Perrow (1967, 1970)
Rice and Bishoprick (1971)		The rights of members to determine the goals of the organization	4	1. Directive or entrepreneurial 2. Consensual 3. Democratic 4. Collegial
Meyer (1977)		The salience of organization goals and the environment	5	1. Insular 2. Oligopolies 3. Competitive 4. Administrative

[a]Extracted from Carper & Snizek (1980b, pp. 68-69).

as complex multidimensional units very similar in nature to other kinds of organizations in our society. For example, this is not meant to suggest that military organizations are identical to industrial organizations. However, the complexity of the organization does call for an approach which accounts for the multi-dimensional nature of the unit being studied. Second, since we anticipated that a large number of variables could potentially be a part of the taxonomy, we concluded that an empirical approach using multivariate statistical techniques would be more logical and better suited for the large array of organizational variables. Such an approach also has the ability to cope with the lower and higher order interactions which may occur with multiple organizational variables. Finally, the empirical approach and the associated multivariate analysis technique would be more closely allied with the general systems theory perspective called for in the statement of work; i.e., the multivariate approach, by its nature is modeled from a general system perspective (see Sells, 1964, p. 515).

The underlying assumptions to the multidimensional organizational taxonomy model approach are summarized in an essay by Sells (1964):

> "1. Organizations are behaving organisms whose behavior is represented by the coordinated, composite action of their members functioning in their roles as organizational members.
>
> 2. The behavior of organizations with respect to any task or index is a predictable function of three major sources of variance, discussed below, which may be referred to as: (1) Characteristics of individuals participating (abilities, motivational and stylistic

personality traits, background, past experience and training, ethnic factors, etc.); (2) organizational characteristics (goals, tasks, group structure, facilities, procedures, etc.); and (3) characteristics of the physical and social environment. It is assumed that significant portions of the variance of behavorial criteria will be accounted for by factors representing these separate sources as well as by other factors representing interactions of these sources.

3. The universes of variables representing persons, organizations, and external environment can be represented by factored dimensions (or common factors) which order the myriad of specific observable characteristics in terms of generalized composites that are both more stable and less redundant, for multivariate prediction, than the specifics by which they are defined.

4. The total variance of any criteria of organizational behavior can be accounted for by weighted combinations of the universe of dimensions of persons, organizations, and environment, within the limits of measurement error. Multiple-regression equations, discriminant functions, or other appropriate multivariate techniques are applicable to the prediction problem, but the development of predictor factors for each of the major sources of organizational behavior, and of suitable criteria, are issues of prior importance.

5. The dimensions of the taxonomy of organizations will be indicated by the differential patterns of predictive weights obtained for various combinations of factors" (p. 516).

What Sells suggests is an empirically derived taxonomic model which accounts for the variance contributed by the multidimensional organizational variables by identifying the underlying factor structure of organizations and/or organizational behavior. This approach seeks the most parsimonious solution by factoring those dimensions which include a majority of the descriptive characteristics of organizations and organizational behavior.

Multivariate, empirically derived organizational taxonomies are

few and far between. Few have approached the specifications outlined by Sells. Those that have been developed are relatively recent in origin. A tabular summary of the empirically derived organizational taxonomic approaches is presented by Carper and Snizek (1980b).

Table 3

A Summary of the Most Frequently Cited Works Using Empirically Constructed Typologies or Taxonomies [a]

Author (Date)	Organization Studied	Criterion Variable(s)	No. of Types	Typologies Specified
Haas, Hall, and Johnson (1966)	The most "common forms of organizations"	Used 99 variables	10	First attempt at an empirical taxonomy of organizations.
Pugh, Hickson, and Hinings (1969)	"Employing units" in Birmingham, England with 250 employees or more	1. Structuring of activities 2. Concentration of authority 3. Line control of work flow	7	Concerned with a taxonomy of organization structures and not of organizations per se.
Goronzy (1969)	American manufacturing firms	1. Size 2. Technology	4	First attempt to specifically apply the principles of numerical taxonomy to the study of organizations.
Samuel and Mannheim (1970)	Israeli manufacurers	1. Structural control 2. Division of labor 3. Inter-level impersonality 4. Normativity	6	A taxonomy of bureaucracy rather than organizations per se Cf. Pugh, Hickson, and Hinings (1969)

[a] Extracted from Carper and Snizek (1980b, p. 70).

LITERATURE REVIEW

Since the empirical approach was selected for this study, our review of the taxonomic literature will focus only on those studies which utilized empirically-derived methodologies for constructing taxonomies. A brief review of the theoretical studies and the rationale for discarding this approach were presented in Table 2 and the accompanying discussion in the previous section. The dates of publication for the empirical studies reviewed below should serve to indicate the compelling need for additional and more recent study and organizational taxonomy developments.

Haas, Hall, and Johnson (1966) were among the first to attempt to develop an empirically derived taxonomy of organizations as an aid to developing more knowledge about organizations and as a possible model for making predictions about organizational behavior. More specifically, they argue that an empirically derived taxonomy of organizations would:

> "1. ... be strategically helpful for refining hypotheses;
>
> 2. ... aid the investigation of the validity and utility of existing typologies based on logical and intuitive considerations;
>
> 3. and ... serve as the basis for predicting organizational decisions or change" (pp. 157-158).

These authors approached the development of a taxonomy with two requirements in mind: first, the taxonomy should be multidimensional and, second, the taxonomy should include "significant" or "im-

portant" variables rather than "trivial" ones. To avoid the problems associated with theoretical or intuitively derived taxonomies, an interdisciplinary group reviewed the literature and extracted all those variables thought to be relevant. An attempt was also made to list additional characteristics based on expert opinions of the research team. The underlying assumption in this study was that a

> "useful taxonomy of organizations... must reflect the characteristics which can, in fact, be found among the myriad of organizations which can be examined. In other words, it was decided to let the data indicate which variables tend to 'hang together' in the world of organizational phenomena as all can observe and record it" (p. 161).

Haas, Hall, and Johnson started with a candidate list of 210 discrete organizational characteristics. From this list, for practical reasons, all those variables requiring the large scale administration of questionnaires to personnel or organizations were discarded. This criterion eliminated from consideration variables associated with individual characteristics and interpersonal structure in organizations. From the original 210 variables a modified list of 99 characteristics were obtained. The major headings are presented in Table 4. Following the development of the variables list an interview schedule was developed to obtain data from organizations regarding each variable. Random selection of organizations to be interviewed relative to the organizational characteristics was not possible. In order to maximize variability, an attempt was made to select organizations reflecting a wide range of organizational types. Following data collection, the basic task was to use a technique

Table 4

List of Organizational Characteristics

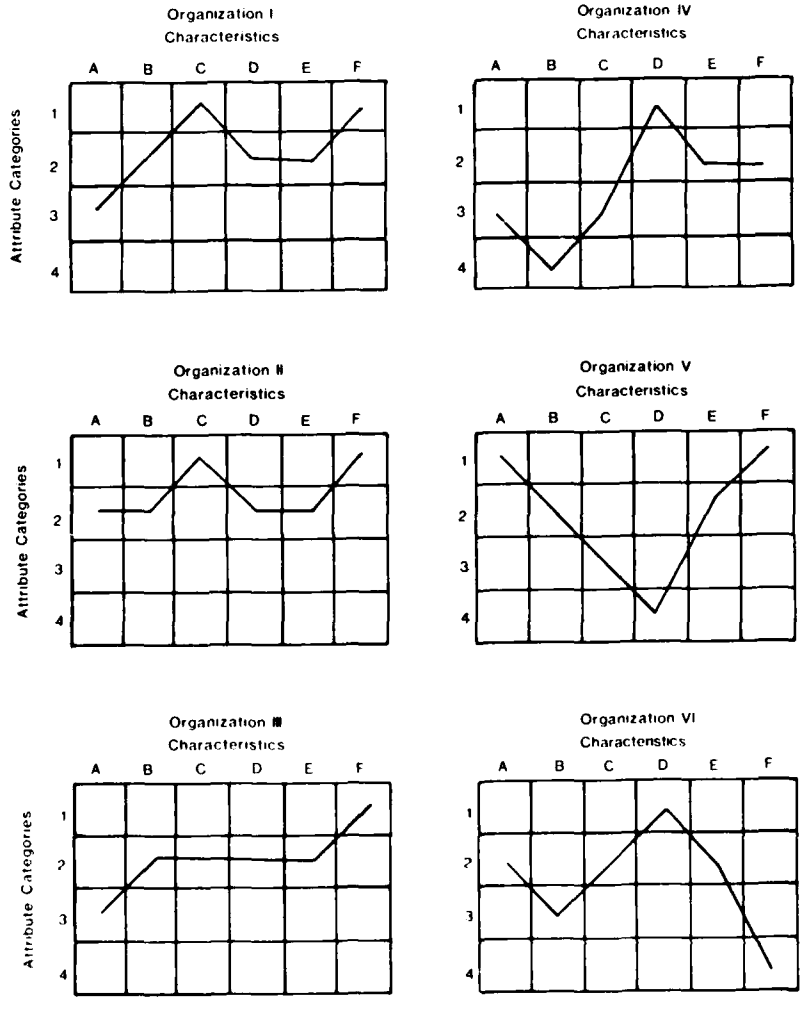
Organizational goals and objectives
Major activities of the organization
Basic organizational character or orientation
General levels of workers (members)
Major divisions or departments (horizontal differentiation)
Vertical and horizontal complexity (combined index)
Geographical dispersion of personnel and facilities
Intradependency of departments
Concreteness of positional descriptions
Committees and boards
Organizational control (source of major policy decisions)
Centralization of authority
Formalization of authority structure
Communication structure
Dependence on written rules and policies
Penalties for rule violation
Emphasis on status distinctions
Manner in which new members enter the organization
Orientation program
In-service training program
Distinctions regarding types of organization members (non-hierarchical)
Number of members, with extent of variation in size of departments
Turnover of membership by level (per year)
Planned limit on size
Restrictions on membership
Dependency on other organizations
Other organizations dependent on one studied
Competition with other organizations
Governmental control and regulation
Supply of potential members
Share of potential customer market
Geographic factors as a handicap
Primary sources of income
Financial condition of the organization
Age of organization
Shifts in major activities throughout history of the organization
Patterns of growth and decline

* Extracted from Haas, Hall, and Johnson (1966, pp. 162-63).

which compares each organization profile to each of the other profiles to determine similarities or affinities of variable sets as per the sample of organizations. Haas, Hall, and Johnson illustrate the basic idea of this comparison procedure in Figure 1. In the one case (Organizations I, II, and III) similar profiles and/or common attributes are present, while in the other case (Organizations IV, V and VI) little profile similarity is depicted (p. 166). The first case could be interpreted as a cluster.

Figure 1

An Illustration of Organizational Profiles[a]



[a] Extracted from Pugh et al. (1969, p. 117).

The illustration greatly oversimplifies the profile comparison exercise, but it does help to emphasize the idea of basic clustering techniques. Because of the size of the data base, Haas, Hall, and Johnson developed a taxonomy computer program for the analysis. Essentially the program, at the first level of analysis, tabulated the "matches" and "non-matches" for each attribute in two organizations. Then each case (organization) was ranked logarithimically in terms of its typicality regarding each attribute within the entire set and its typicality with other cases having similar values or attributes in common. The organization ranking first in terms of the typicality measure within the set is designated as the "prime node" and organizations similar to it cluster around the prime node. Criteria can be established by the researchers regarding the similarity value for other organizations in order to be a part of the cluster. Each cluster is successively removed from the base, and other clusters are analyzed.

Through the analysis of the organization - attribute matrix, they were able to determine those attributes or organizational characteristics which were responsible for organizations being put in the various clusters. Table 5 depicts an example of one organizational order (cluster) with its incumbent characteristics.

Table 5

Illustration of Decreasing Number of Specificity of Attributes: "Phylum" Social System, "Order" O_1, and "Species" S_1 (Fourth Level)[a]

Level		Attributes
"Phylum"	Social System	1. Functional interdependence of parts 2. Relative stability of structure 3. Persistence over time
"Order"	O_1	1. They have characteristics of the level above them 2. When organizations of this order are compared to other organizations on geographic factors, they are average 3. There are no departments engaged in the production of goods for internal use 4. Persons enter the organization by simply signing up 5. There are no religious restrictions for membership
"Species"	S_1[b]	1. They have characteristics of the levels above them 2. Three goals 3. One department is engaged in the production of goods for external distribution 4. Penalties for rule violation are clearly stated 5. Penalites for rule violation are stipulated in writing 6. In-service training is highly formalized for upper levels 7. In-service training is loosely structured for lower levels 8. Paid employees number 2,000 to 3,999 9. Yearly turnover of lower levels is 0-5%.

[a] Extracted from Haas, Hall and Johnson (1966), p. 177.

[b] Although 17 attributes emerged which are unique to S_1, only 9 are presented for illustrative purposes

Haas, Hall, and Johnson conclude that their technique yields results nearly identical to the model used in biological and zoological taxonomies. They found, among other things, that: (1) the analysis yielded the same number of levels, six, as found in the zoological taxonomy; i.e.,

1. Phyla
2. Class
3. Order
4. Family
5. Genus
6. Species

(2) homogeneity within clusters decreases as the hierarchy is ascended; and (3) the number of characteristics or variables per organizational cluster and the specificity of those variables decreases as the hierarchy is ascended (p. 179). The major goal of this study, to develop a model for deriving empirical taxonomies of organizations, was achieved. A computer program compared each organizational profile with every other profile based on a common list of selected characteristics to isolate homogeneous clusters of organizations. The research yielded ten such organizational clusters which were then further analyzed and placed in the taxonomic scheme discussed in this section.

Pugh, Hickson, and Hinings (1969) present an empirical taxonomy of work organizations based on three empirical dimensions: structuring of activities, concentration of authority, and live control of work flow. Their taxonomy of organizational structures was derived from a previously reported correlational analysis (Pugh, Hickson,

& Hinings, 1969). Sixty-four scales were developed to operationally define five major structural variables: "(1) Specialization of functions ..., (2) standardization of procedures ..., (3) formalization of documentation ..., (4) centralization of authority ..., and (5) configuration of position ... (p. 116)." These scales were factor analyzed with the three previously mentioned factors accounting for most of the variance. Using this three factor paradigm the standard scores from 52 organizations were plotted on one structural dimension against another. Figure 2 (Pugh, et al., 1969, p. 117) depicts the "concentration of authority" dimension plotted against "structuring of activities". The figure provides a graphic illustration of the obvious clustering of various organizations in various quadrants. The taxonomy can then be achieved by concentrating on descriptions of the organizational structures in the quadrants having clusters.

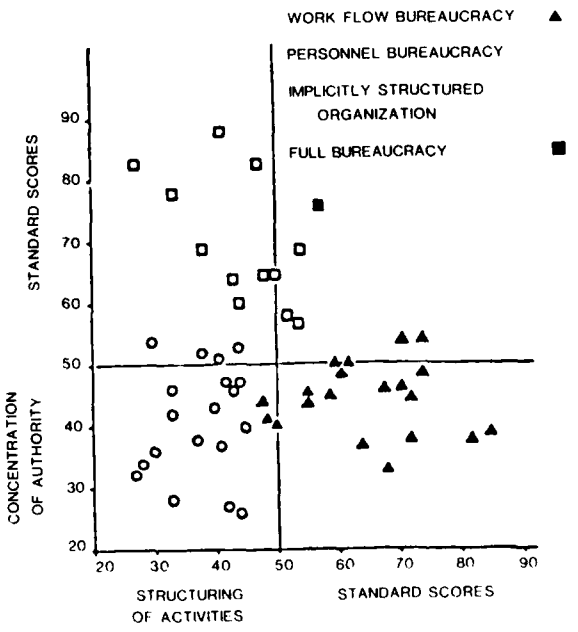


Figure 2. Concentration of Authority[a]

[a] Extracted from Pugh et al. (1969, p. 117).

Based on the two dimensional cluster analysis (Figure 2) and with the addition of the third structural dimension, "line control of work flow," Pugh, Hickson, and Hinings were able to categorize organizations into seven specific types:

Full bureaucracy
    Nascent full bureaucracy
Work flow bureaucracy
    Nascent work flow bureaucracy
    Pre work flow bureaucracy
Personnel bureaucracy
Implicitly structured organization

For this particular sample of organizations Table 6 lists the organizations as they clustered via the classification procedures.

Table 6

Clustering of Organizations[a]

Cluster and Organization product or service	
Full bureaucracy ($N = 1$)	**Preworkflow bureaucracy ($N = 11$)**
Repairs for government department	Four metal component manufacturers
Nascent full bureaucracy ($N = 4$)	Motor component manufacturer
Civil engineering firm	Two metal goods manufacturers
Abrasives manufacturer	Carriage manufacturer
Local authority transport department	Engineering tool manufacturer
Paper manufacturer	Food manufacturer
Workflow bureaucracy ($N = 15$)	**Personnel bureaucracy ($N = 8$)**
Vehicle manufacturer	Government inspection department
Food manufacturer	Local authority baths department
Confectionery manufacturer	Cooperative chain of retail stores
Tire manufacturer	Local authority education department
Nonferrous metal manufacturer	Savings bank
Printer	Local authority civil engineering department
Three motor components manufacturers	Food manufacturer
Commercial vehicle manufacturer	Local authority water department
Omnibus company	**Implicitly structured organizations ($N = 8$)**
Glass manufacturer	Component manufacturer
Metal motor components manufacturer	Chain of retail stores
Heavy electrical engineering equipment manufacturer	Department store
Aircraft components manufacturer	Insurance company
Nascent workflow bureaucracy ($N = 5$)	Research division
Metal goods manufacturer	Chain of shoe repair shops
Components manufacturer	Building firm
Brewery	Toy manufacturer
Engineering component manufacturer	
Domestic appliances manufacturer	

[a] Extracted from Pugh et al. (1969, p. 120).

Finally, Pugh, Hickson, and Hinings illustrate how the taxonomy comes together relative to the types of organization structure and the relationships between the structural dimensions and types of organization. Figure 3 depicts this relationship.

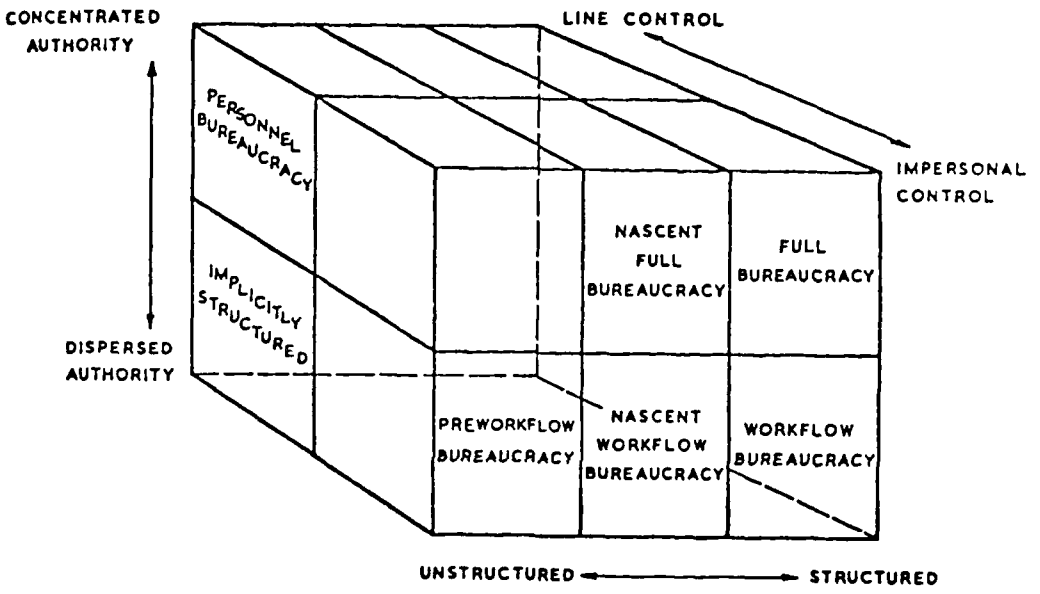


Figure 3. Relationship Between the Clusters[a]

The main purpose of this research was to utilize an empirically derived taxonomy of organizational work structures to generate a classification system for a sample of work organizations. The results of this study have implications for Weber's original conceptualization of bureaucracy and for the methods of empirical taxonomy development in organizational theory. The findings suggest that "bureaucracy" is a multidimensional concept and that multidimensional, empirically derived multivariate techniques should be used in the

[a] Extracted from Pugh et al. (1969, p. 12).

development of taxonomies of organizations.

Goronzy (1969) was the first to attempt an application of the numerical taxonomy model to the study of organizations. Data were collected from 50 American manufacturing firms on a variety of organizational variables. A list of 29 selected variables from the study along with the resulting clusters is presented in Table 7.

Table 7

Means of 29 Selected Variables for 4 Clusters Joined with Average Linkage on the Basis of Correlation Coefficients[a]

Variables		Cluster 1 11 Firms	Cluster 2 6 Firms	Cluster 3 11 Firms	Cluster 4 22 Firms
Total Sales	1	$21,400,000	$53,200,000	$ 8,400,000	$10,000,000
Direct Sales	2	$ 6,500,000	$47,600,000	$ 7,000,000	$ 5,800,000
Other Sales	3	$14,900,000	$ 5,600,000	$ 1,400,000	$ 4,200,000
Sales per Employee	4	$ 20,250	$ 25,880	$ 19,400	$ 29,240
Sales per Production Worker	5	$ 32,000	$ 50,680	$ 36,100	$ 77,400
Customer Accounts	6	1,920	2,600	5,740	757
Customer Orders per Month	7	800	630	2,040	854
Order Changes per Month	8	15	94	153	58
Total Assets	9	$17,900,000	$38,400,000	$ 5,300,000	$ 6,400,000
Fixed Assets	10	$ 4,600,000	$10,000,000	$ 1,500,000	$ 1,700,000
Capital-Output Ratio	11	0.67	0.72	0.57	0.69
Technology-Capacity Index	12	18,750	52	40,470	930
Parts Orders per Month	13	430	623	892	612
New Products in 3 Years	14	8	5	5	10
Average R & D Time (Years)	15	1.7	1.6	0.9	1.4
Engineering Changes	16	58	375	89	32
Part Numbers	17	8,250	30,500	5,285	9,872
Total Employment	18	986	2,070	415	358
Production Workers	19	600	1,055	225	183
Number of Foremen	20	41	56	15	7
Number of Other Superiors	21	58	124	38	37
Unit of Supervision	22	15	23	13	27
Number of Subordinates	23	4	7	4	5
Division of Labor	24	0.96	0.98	0.92	0.8
Sales Department	25	58	157	65	55
Manufacturing Department	26	755	1,517	291	243
R & D Department	27	40	196	20	29
General Administration	28	55	204	40	36
Fixed Assets/Production Worker	29	$ 5,030	$ 8,950	$ 6,420	$ 15,025

[a] Extracted from Goronzy (1969, p. 47).

A correlation analysis between enterprises or taxa was conducted to serve as input data for the numerical taxonomy program developed by Sokal (1963). This program is essentially a cluster analysis and the results of that method are depicted in Figure 4.

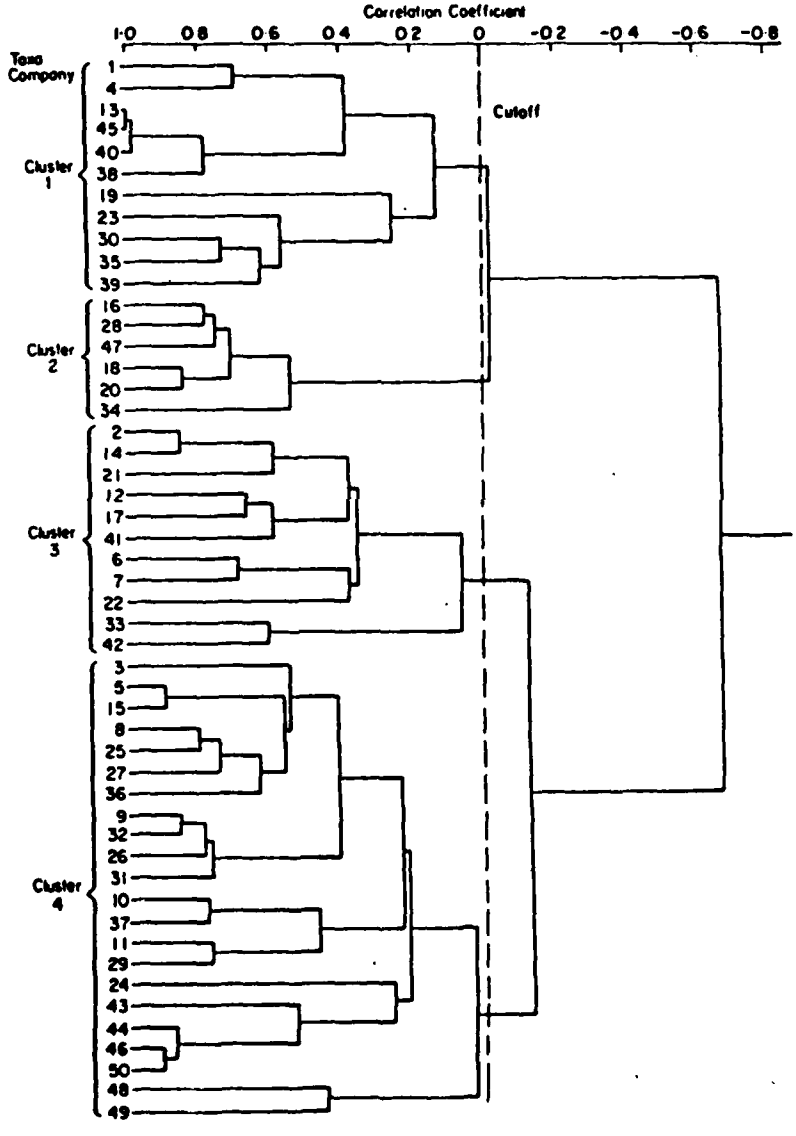


Figure 4. Dendogram Based on Correlation Coefficients Joined by Average Linkage[a]

[a] Extracted from Goronzy (1969, p. 44).

Goronzy cautions the reader not to "overintepret" the results of this taxonomy. He does suggest, on the basis of the clusters outlined in the dendogram and from an interpretation of the findings presented in Table 7, that "the four clusters approximate a four-way classification on the basis of size and technology" (p. 46). Clusters 1 and 3 represent companies manufacturing simple technical products in mass quantities such as fans. Clusters 2 and 4 consist of firms who produce complex machinery in small lots.

Samuel and Mannheim (1970) identified types of bureaucracy by collecting data from 30 industrial plants on four areas related to bureaucracy: "(1) structural control reflected by the hierarchy of authority; (2) division of labor of functionalization, ... (3) inter-level impersonality, ... and (4) normativity, embodied in rules, regulations, and procedures..." (p. 217). The data were analyzed by a computerized nonmetric analysis and classification method called Guttman-Ligoes multidimensional scalogram analysis - I(GL-MSA-I). The technique is similar to that developed by Haas, Hall, and Johnson where similar organizational profiles regarding each of the characteristics or attributes causes organizations to form clusters which, in turn, serve to define the taxonomy.

The major purpose of that research was to present the methodological approach. Figure 5 depicts the results of the methodology relative to identifying clusters of organizations.

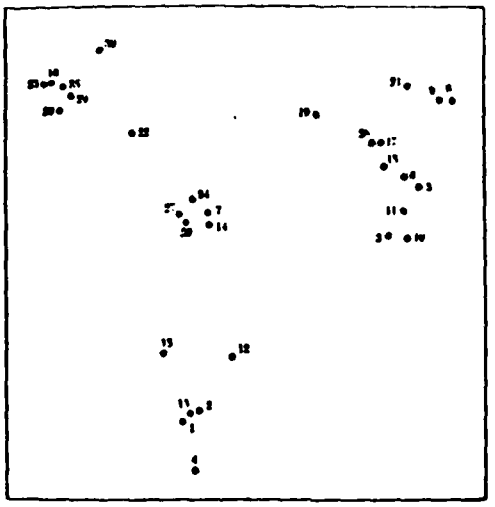


Figure 5. Space Diagram: General Distribution of Profiles [a]

The analysis of the profiles yielded six dominant types of bureaucracy: rudimentary, emergent, interpersonal, balanced, managerial, and technical. Hence the study demonstrated the feasibility of a multidimensional approach and multivariate statistical methods for generating taxonomic information.

Prien and Ronan (1971) factor analyzed 38 measures of organization characteristics for 107 small metal working firms. Underlying this research was the belief that "relatively little work has been undertaken solely to describe and understand the structural characteristics of an organization, or those that are common to organizations" (p. 216). Prien and Ronan argue that it is necessary to describe the organization in terms of the relationships among economic and social-psychological variables as they are determined empirically.

[a] Extracted from Samuel and Hannheim (1970, p. 223).

The researchers collected data on 38 variables as depicted in Table 8.

Table 8

Organization Variables, Patterned Interview Questions, and Direction of Scoring [a]

Variable	Item and source of data	Score
	Accounting and Financial	
1*	Break even point, % capacity	
	Interview with president	
2*	When was company founded (age)	
3*	Number of employees (total)	
4	(% female)	
5*	Annual sales	
6*	(Growth % present (-) 3 years ago/3 years ago	(+20)
7	Long-term Company objectives	
	Increase sales	
	Gradual growth	1
	Maintain current status	
	No plans	0
	Dun & Bradstreet Report	
8	Current chief executive	
	Company founder or with partner	1
	Any other style of acquisition	0
9	Previous position of chief executive	
	Supervision or above	1
	Nonsupervisory	0

[a] Extracted from Prien and Ronan (1971, pp. 219-221).

Table 8 (Continued)

Variable	Item and Source of Data	Score
	Marketing Management	
10*	Is company currently selling original line or service	
	Yes	1
	No	0
11	Source of idea for current major product	
	Self	1
	Elsewhere	0
12*	% of quotes resulting in contracts	
13*	Cost of advertising as % of sales - 0.0 to 9.9	
14*	Extent of change of product since founding	
	Same product as when founded	1
	Added new products with opportunity	2
	Active program of product planning and development	3
15*	Company experience with product development	
	Successful	1
	Unsuccessful or uncertain	0
16*	Company experience with product diversification	
	Successful	1
	Unsuccessful or uncertain	0
17*	Dollar amount of average company sale	
	3-99	1
	100-199	2
	200-499	3
	500-999	4
	1,000-1,999	5
	2,000-9,999	6
	10,000-125,000	7
18*	Number of present and potential customers	
	100-199	
	200-299	
	300-399	
	400-499	
	500-599	
	600-699	
	700-799	
	800-899	
	900 and above	
	Production and Personnel Management	
19	Company conducts time studies	
	Yes	1
	No	0
20*	% of factory employees who are skilled	
21	Average hourly rate of factory employees	
22*	% of factory employees receiving average hourly rate	

Table 8 (Continued)

Variable	Item and Source of Data	Score
23*	Average length of service of production workers	
	Less than 1 year	1
	1-5 years	2
	6-10 years	3
	11-15 years	4
	over 15 years	5
24	Stability of employee job assignments	
	Stable	1
	Diverse	0
25 25	Quality demands of market	
	Extremely high	1
	High	2
	Ordinary	3
26	Company has a quality control function	
	Yes	1
	No	0
27*	Cost of inspection of % of product cost, record range 0.0 to 9.9 to nearest tenth	
28*	Scrap rate as compared to industry	
	Higher than average	1
	About average	2
	Lower than average	3
29	Company has a formal personnel program	
	Yes	1
	No	0
30	Company uses job descriptions	
	Yes	1
	No	0
31	Company uses job evaluations	
	Yes	1
	No	0
32	Company uses merit ratings	
	Yes	1
33	Company has an incentive plan	
	No	0
34	Number of benefit plans	
35	Company allows stock purchase	
	Yes	1
	No	0
36	Company has a pension plan	
	Yes	1
	No	0
37*	Operate under collective bargaining contract	
	Yes	1
	No	0
38	Company has regular employee promotion lines	
	Yes	1
	No	0

* Output variables

A product moment correlation matrix was factor analyzed using the principal components method with a varimax rotation procedure. The analysis yielded nine factors as determined from variables with loadings of .30 or higher. The factors emerging were as follows:

Factor I. Standardization: Individual Roles

Variable		Loading
32	Company has a merit rating plan	45
31	Company uses job evaluations	42
35	Number of benefit plans	39
30	Company uses job descriptions	36
28	Company has regular employee promotion lines	35
23	Average length of service of production employees	31
25	Quality demands of market	30

Factor II. Change, products, and technology (See Prien & Ronan, 1971, pp. 225-232 for the variables loading on Factors II-IX.)

Factor III. Succession

Factor IV. Specialization

Factor V. Marketing Strategy

Factor VI. Standardization: Individual Recognition

Factor VII. Organization Size

Factor VIII. Unnamed

Factor IX. Quality production

While previous empirical studies attempted to classify organizations as per a selected list of organizational characteristics which seemed relevant, this study attempted to organize or classify a set of descriptive organizational characteristics (variables) as per a selected sample of organizations. Essentially, this approach

suggests that the real world of organizations can serve, via a multivariate statistical technique, as a determinant of an organizational taxonomy. According to Prien and Ronan, the results of this kind of approach include using these kinds of data in studies of human performance to determine the effects of variation of organization characteristics on individual behavior and performance (p. 232."

Pinto and Pinder (1972) conducted a study of 227 organizations which were cluster-analyzed via their similarity profiles across 18 behavioral dimensions of effectiveness. In what they term a "new approach" Pinto and Pinder suggest that techniques commonly used in the behavioral sciences to deal with homogeneous groupings of individuals based on their similar test profiles can also be applied to organizational units based on selected dimensions of, in this study, organizational effectiveness. For example, those organizations with similar profiles regarding goal emphasis, delegation, turnover, and satisfaction, to name a few, would tend to cluster together when subjected to data collection and cluster analytic procedures.

Ratings on 18 organizational behavior dimensions served to subgroup 227 organizational units. Table 9 lists and defines the organizational effectiveness (OE) dimensions that were used. The cluster analysis technique, the hierarchical grouping procedure, homogeneously groups organizational units as per their profile similarities. Eight clusters were found to satisfy the optimal solution criterion. An overall mean effectiveness rating was determined for

Table 9

Dimensions of Organizational Effectiveness[a]

Dimension	Descriptive definition
Flexibility	Willingness to try out new ideas and suggestions, ready to tackle unusual problems.
Development	Personnel participate in training and development activities.
Cohesion	Lack of complaints, grievances, and conflicts.
Democratic supervision	Subordinate participation in work decisions.
Reliability	Meets objectives without necessity of follow-up and checking.
Delegation	High degree of delegation by supervisors.
Bargaining	Rarely bargains with other organizations for favors and cooperation.
Results emphasis	Results, output, and performance emphasized, not procedures.
Staffing	Personnel flexibility among assignments; backups available.
Decentralization	Work and procedural decisions delegated to lowest levels.
Planning	Operations planned and scheduled to avoid lost time; little time spent on minor crises.
Cooperation	Operations scheduled and coordinated with other organizations; rarely fail to meet responsibilities.
Productivity-support-utilization	Efficient performance; mutual support and respect for supervisors and subordinates; utilization of personnel skills and abilities.
Communication	Free flow of work information and communications within the organization.
Initiation	Initiates improvements in work methods and operations.
Supervisory control	Supervisors in control of progress of work.
Conflict	Little conflict with other organization units about authority or failure to meet responsibilities.
Supervisory backing	Supervisors support their subordinates.

[a]Extracted from Mahoney and Weitzel (1970, p. 410).

each cluster, and analysis and discussion focus on the underlying causative dimensions associated with the differential effectiveness of each cluster.

This study was able to show that cluster analytic techniques can be used in relation to selected OE characteristics to determine the variables related to overall unit effectiveness. The study was not able to show where interactions among behavioral style and demographic variable create differences in overall unit effectiveness, or what particular pattern of OE characteristics seems to create the most effective organization.

Reimann (1974) examined the effectiveness of 19 manufacturing organizations relative to structural dimensions. More specifically, Reiman posed two research questions:

"1. What differences, if any, exist between the structural dimensions of relatively high and low performing organizations?

2. If different from those of low performing organizations, what are the dimensions associated with the relatively high performing organizations?" (p. 695)

Organizational effectiveness was operationally defined using the organizations' executives ratings of the companies sales, profits, the firms ability to attract and keep high-level manpower, satisfaction and morale of employees, quality of the organization's products, service to customers, future growth potential, and the

rating which its competitors might give the company for its performance. Organization structure was conceived in a multidimensional scheme consisting of variables nearly identical to those used by Pugh, Hickson, and Hinings (1969). A nonmetric cluster analysis was selected for the analysis in this study since a number of the structural attributes were measured with nonmetric ordinal scales. High performance and low performance was determined by splitting the firms at the median on the overall effectiveness and executive turnover indicators.

The results of the study indicated three distinct clusters that differentiate between high and lower performance. The clusters are presented in Table 10.

Table 10

Structure Clusters for All Firms[a]

Cluster 1:	*Decentralization*	
Measures:	Delegation of authority	
	Centralization index [a]	
Cluster 2:	*Specialization*	
Measures:	Functional specialization	
	Vertical span	
	Functional specificity	
	Hierarchical control	
Cluster 3:	*Formalization*	
Measures:	Formalization of roles	
	Lack of autonomy	
Rank correlations between clusters: [b]		
	Clusters 1 & 2	.23
	Clusters 1 & 3	−.07
	Clusters 2 & 3	−.11

Note: Smallest rank correlation between measures in any cluster significant at .05 level.
[a] Reversed (negative correlation).
[b] Cluster scores computed by summing the firms' ranks for all measures comprising each cluster (reversing ranks for negatively correlated measures).

[a] Extracted from Reimann (1974), p. 703.

The dimensions derived from this analysis--decentralization, specialization, and formalization--appeared to be relatively independent based on the low and insignificant rank correlations between the clusters.

Reimann concludes by viewing these orthogonal structural dimensions as predictive of the effective organization. Figure 6 depicts the effective organization as one that is "relatively decentralized, specialized, and formalized, as represented by position A in the structure space" (p. 706).

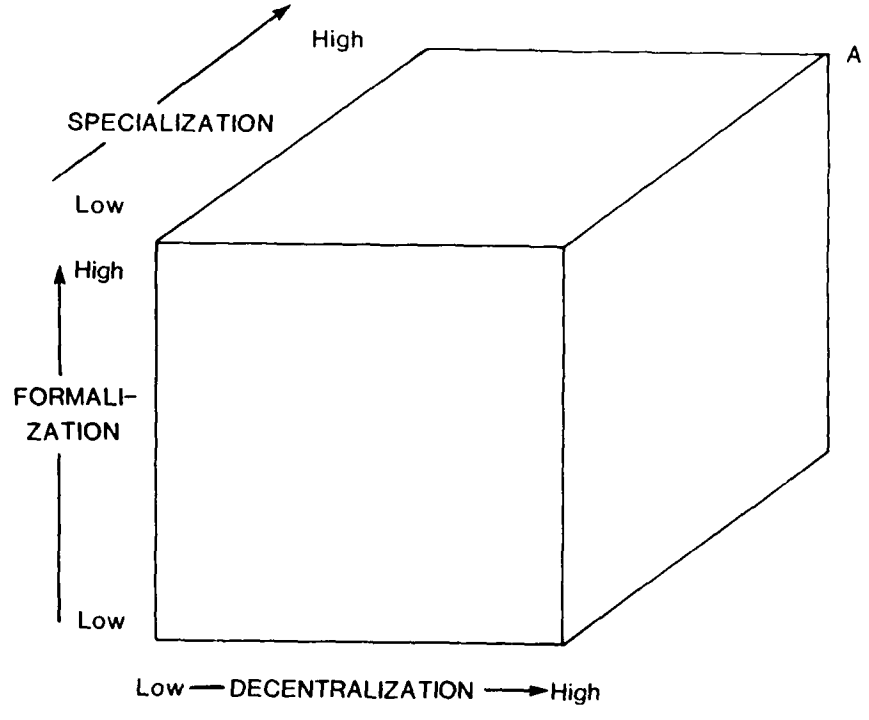


Figure 6. "Structure Space" of Effective Organizations[a]

[a] Extracted from Reimann (1974, p. 706).

SUMMARY OF THE LITERATURE REVIEW

A review of the literature regarding empirical taxonomies of organizations identified only seven studies in which a taxonomy or typology of organizations or organizational variables was developed using empirical research methods. A majority of these studies used some form of cluster analysis. One study used numerical taxonomy procedures and several utilized factor analytic procedures in preliminary parts of the analysis. Most of the research focused on classifying organizations based on their similarities to a list of selected organizational attributes. One study sought to develop a taxonomy of organizational variables based on data collected from organizations. In terms of the criteria discussed earlier in this report, none of the research reviewed here met the requirements designated by McKelvey (1975a) or Sokal and Sneath (1963). If anything is to be learned from the literature review, it is that taxonomy development in organizational theory is a multidimensional enterprise requiring multivariate statistical approaches. In light of the limited generalizability of those studies reviewed here, future research efforts need to focus more carefully on the methods of attribute selection, sampling of organizations, and the statistical model chosen for the analysis.

OVERVIEW OF THE PRESENT EFFORT

The present study combines some of the methodologies and analysis techniques found in previous studies to develop a multidimensional empirically derived taxonomy of organizational variables grounded in organizational/industrial psychology and relevant to general systems theory. The present study departs from others regarding the use of organizations to collect data as input to taxonomy development. In the present study rather than interviewing organization personnel and executives to gather data relative to a selected list of organizational attributes, we elected to "interview" some 200 randomly selected organizational theorists and researchers on the basis of their published studies.

In the sections that follow, this report will:

- Present a brief discussion of the procedure used for selecting the list of variables to serve as the basis of the taxonomy development;
- Outline the procedure used to select a sample of articles to be evaluated against the list of selected organizational attributes;
- Discuss the methods and models used, including pilot studies to develop the empirical taxonomy of organizations;
- Present and discuss results of the study.

SECTION 2.0 PROCEDURES AND METHODS

THE LIST OF VARIABLES

Selection of the set of relevant organizational variables without doubt constituted the most significant initial task of the overall taxonomy development process. The objective established for this purpose was to identify those variables -- attributes or characteristics -- the existence of which reasonably could be expected to exert an influence on, or contribute to, organizational behavior and performance. By agreement, this excluded consideration of (1) particular methodological or analytical techniques or tools, such as gaming/simulation, modeling, sampling, surveys, testing instruments, training aids, etc.; (2) specific theoretical fields of thought or modes of inquiry, e.g., field theory, contingency theory, path-goal theory; and (3) "meta-organizational", or global, constructs, such as administration, bureaucracy, society, politics/economics, etc.

The criteria established for inclusion or exclusion of terms were as follows:

- Variables selected should constitute, as nearly as possible, a <u>comprehensive</u> representation of all recognized facets of organizational behavior and performance; on the other hand, where multiple terms have accepted meanings that are virtually synonymous, <u>parsimony</u> should be the overriding consideration.
- Variables selected must be an integral component of, coincident with, or readily adaptable to accepted systems-theoretic concepts.

- Variables selected should focus on systemic/subsystemic attributes rather than on essentially individual psychological states or manifestations, e.g., alienation, attitudes, bias, cognition, emotion, morale, motivation, etc.

Six sequential steps were followed in establishing the final list of variables. Step 1 involved a review of the indexes and topical headings of major texts in the field of management, organization theory, and organizational psychology. From this a preliminary listing of some 350 terms was formulated. Step 2 was an "experting" review of the terms by senior study team members to add, delete, or combine terms as necessary. Step 3 was a winnowing of those terms that represented essentially individual psychological states or manifestations and thus, as noted above, were considered inappropriate. Step 4 was an extension of the preceding step, a refined winnowing process in which the applicability of terms to accepted systems theoretic concepts was the discriminator. In the interest of parsimony, Step 5 was undertaken to combine essentially duplicative terms, i.e., those which were roughly, though not necessarily precisely, synonymous (for example development-dynamic equilibrium-morphogenesis, interaction-cooperation-coordination, etc.). Step 6 involved a final review of, and consensual agreement on, the final list of terms by study team members. This final list of 84 terms and associated systems-based definitions are presented in Appendix A.

SELECTION OF ARTICLES

A pool of over 500 articles was selected from the literature in five areas which were generally defined as being relevant to the present research problem. These areas included:

- Organizational Psychology and Behavior
- General Systems Theory
- Organizational Effectiveness and Development
- Simulation
- Training

From this literature pool (see: Davis et al. 1980 for the selection rationale, search procedures, and an annotated bibliography of the literature pool). Approximately 240 articles were selected for evaluation and a pilot run of the factor analysis. Over 40 articles were randomly selected from each of the 5 categories defined above. Following the evaluation and factor analysis of the pilot sample (results are presented and discussed below), a random sample of over 200 articles was selected from the pilot sample and the complete literature pool for the final evaluation and factor analysis. The manner in which the second sample was determined was designed to reflect our concern for the representativeness of the literature which served as input data to the pilot and final factor analysis programs. Here we reasoned that the representativeness of the initial factors as per the pilot sample and the reliability of the factor structure could be validated by the sampling selection plan contained in this study.

EVALUATION OF THE LITERATURE

The development of an approach to evaluate the literature was based upon a method previously developed for Air Force applications (Shumacher, Swezey, Pearlstein, and Valverde, 1974). This adaptation of the Shumacher et al. technique involved classification of each document according to a system which described the primary types of documents reviewed during this project. Table 11 shows the document classification system.

Following are brief definitions for each type of document:

1. Opinion Articles: Documents that present an author's educated opinion.

2. Theoretical Discussion: Documents where a theory (or theories) is presented or developed; or where existing theories are discussed or critiqued.

3. Methodological Development Articles: Technical notes concerning the development or modification of methodology. Developments reported in this type of document may have been tried in a systematic fashion, based on prior research results, or may simply be suggestions.

4. Evaluative Summaries: Documents that summarize the knowledge in a specific subject area and that also present critical commentaries on the state-of-the-art for that subject.

5. Literature Reviews: Documents that present summaries of specific literature within a subject area and which do not necessarily include critiques of that literature.

Table 11

Classification System for Documents

Type of Document

	Book	Artidle	Report	Other
Opinion				
Theoretical Discussion				
Methodological Development				
Evaluative Summary				
Literature Review				
Statistical Sampling Survey				
Correlational Research				
Experimental Research Study				
Observational Research				
Quasi-Experimental Research				
Simulation				
Free				
Experimental				
Computer				
Gaming				
Role Playing				
Field				
Lab				

6. Statistical Sampling Studies: Documents which include reports of survey, questionnaire, and interview studies in which the techniques of statistical sampling have been applied.

7. Correlation Research: Documents that report correspondence among variables based on correlation coefficients or methods based on correlation matrices.

8. Research Studies in which Variables Are Manipulated: Documents that report research studies in which independent variables were manipulated, and associated changes on dependent variables were recorded.

9. Observational Research: Documents which report research where data are collected on the basis of observation of subjects (includes participant-observation).

10. Quasi-Experimental Research: Documents which report on research studies of a quasi-experimental nature as defined by Campbell and Stanley (1963).

11. Simulation: Documents which report on research in which a complex operating model containing central features of interacting organizational systems and their components function for given periods through space and time. The simulation studies may be further classified as free, experimental or computer based.

12. Gaming: Documents which report experimental methods in which two or more persons or groups compete with each other for a given or variable outcome. The method specifies the rules of the competition and typically provides continuous feedback about outcome status after each of the competitors has made one move.

13. Role Playing: Documents which report research in which the subjects involved take on the roles of

other people and attempt to act out the other's feelings, thoughts, and behavior.

14. Field Research: Documents which report research conducted in a field setting.

15. Laboratory Research: Documents which report research conducted in a laboratory setting.

Documents were also classified according to three additional criteria:

1. The author's stated purpose in writing the document, and the extent to which it was achieved.

   - Author's Stated Purpose:
   - Was Purpose Adequately Achieved? Yes____ No____

2. The significance of the document relative to the objectives of the research project.

   ☐ Highly Significant

   ☐ Significant

   ☐ Insignificant

3. The extent to which the document's abstract was acceptable for inclusion in an annotated bibliography produced as a separate product of the research effort.

   Evaluation of Abstract

   ☐ None

   ☐ O.K.

   ☐ Rewrite

A checklist format was developed to aid reviewers in establishing the extent to which each document reviewed addressed the 84 systems theoretic variables of interest to the study. The checklist

was designed to provide a basis for determining the extent to which an author treated each of the listed variables according to a four point rating scale as follows:

0 = the variable was not mentioned by the author(s).

1 = the variable was minimally mentioned: i.e., the variable may have been mentioned as one of many in a literature review, for example, but was not the major thrust of the discussion.

2 = the variable was discussed: i.e., one of several (5-10) topics treated.

3 = the variable was emphasized: i.e., one of the major topics (1-4) discussed.

Table 12 shows the checklist format.

Table 12

Document Checklist Format

Checklist

Instructions: The check list is designed to provide a basis for determining the extent to which an author treats each of the variables listed. Check the appropriate box for each variable as follows:

0 = the variable was not mentioned by the author(s).

1 = the variable was *minimally mentioned*: i.e., the variable may have been mentioned as one of many in a literature review, for example, but was not the major thrust of the discussion.

2 = the variable was *discussed*: i.e., one of several (5-10) topics treated.

3 = the variable was *emphasized*: i.e., one of the major topics (1-4) discussed.

0	1	2	3		
				1.	Absenteeism
				2.	Adaptability (adaptation, coping, flexibility)
				3.	Authority
				4.	Boundary
				5.	Capability (capacity, potential)
				6.	Centralization
				7.	Certainty
				8.	Change (innovation)
				9.	Change Agent
				10.	Channel (network)
				11.	Climate (organizational climate/ health /pathology/personality)
				12.	Closed System
				13.	Communications (bargaining, information exchange)
				14.	Communication Barriers/Filters
				15.	Competence
				16.	Complexity (dimensionality, dimensions)
				17.	Conflict (role conflict, value conflict, competition, confrontation)
				18.	Conflict Regulation
				19.	Consensus (agreement)
				20.	Control (accountability, compliance, conformity, correction, maintenance, regulation)
				21.	Creativity
				22.	Decentralization
				23.	Decision-Making (choice, problem-solving)
				24.	Development (dynamic equilibrium, evolution, heterostasis, morphogenesis)
				25.	Differentiation (compartmentation, division of labor, elaboration, specialization)
				26.	Direction (intentionality)
				27.	Disorganization (disorder, entropy)
				28.	Efficiency
				29.	Environment (situation)
				30.	Equifinality
				31.	Equilibrium (balance, homeostasis, morphostasis, stability, steady state)
				32.	Feedback
				33.	Goals (objectives, requirements)
				34.	Goal Attainment (performance, productivity)
				35.	Goal Displacement
				36.	Goal Setting (expectancy, expectations)
				37.	Goal Succession (ideal seeking)
				38.	Group Dynamics
				39.	Growth
				40.	Hierarchy
				41.	Incentive (reinforcement, reward)
				42.	Independence (autonomy, totipotentiality)
				43.	Influence
				44.	Information (experience, knowledge, learning, variety)
				45.	Initiative (proaction)
				46.	Input (contribution, resources)
				47.	Integration (symbiosis)
				48.	Interaction (cooperation, coordination, human relations, participation)
				49.	Interdependence (partipotentiality)
				50.	Intervention (third party intervention)
				51.	Job (function)
				52.	Job Enrichment/Enlargement
				53.	Job/Task Analysis
				54.	Management
				55.	Maturity (maturation, organizational life)
				56.	Open System (permeability)
				57.	Optimization
				58.	Organization (cohesion, negative entropy, order)
				59.	Output (product)
				60.	Performance Evaluation/Appraisal
				61.	Plan/Planning (strategy/strategies)
				62.	Power (coercion, dominance)
				63.	Process (conversion, implementation, throughput, transformation)
				64.	Resource Allocation/Distribution
				65.	Response (reaction)
				66.	Responsibility
				67.	Rigidity (change resistance)
				68.	Role (relationship)
				69.	Sensing (cognition, forecasting, intelligence, scanning)
				70.	Simplicity (routinization)
				71.	Size
				72.	Standards (critical variables, norms, regulations, rules)
				73.	Structure (design, form, formalization)
				74.	Suboptimization (equity, satisficing)
				75.	Subsystem (component, group, team)
				76.	Synergism (gestalt, holism, organicism)
				77.	Task
				78.	Technology (automation)
				79.	Training
				80.	Turnover
				81.	Uncertainty (risk)
				82.	Values
				83.	Other (state)
				84	Leadership
				85	Effectiveness

METHODS AND STATISTICAL MODELS

The effort included two pilot studies; one associated with the evaluation instrument, and a second associated with the factor analysis procedure selected for the taxonomy development, leading to the taxonomy of organizational variables. The first pilot study reflected a concern for the inter-rater reliability of those doing the evaluation. The second pilot study was conducted to validate the factor analysis program with data from selected articles. This run was also designed to obtain preliminary assessments of the number of meaningful factors that might be derived from such a program. The rationale for the factor analysis model and a more detailed discussion of the pilot studies are presented below.

THE STATISTICAL MODEL

The factor analysis model was selected for this study for a number of reasons. First the nature of the problem itself suggested this kind of statistical model. The overall objective of this study was to provide an ordered set of organizational attributes grounded in the system theoretic framework in order to provide a model for the literature review and to aid in identification of research needs. With the potentially large number of variables (attributes) which could be considered relevant to the broadly defined field of organizational psychology and general systems theory (we initially identified nearly 400 variables), a multivariate technique which systematically reviews

the correlations or affinity clusters among the variables and reduces the set to a more organized and manageable group of factors was needed.

A majority of the previous research and organizational taxonomists reviewed in this report have suggested factor analytic techniques as one way of achieving parsimony in the taxonomies of organizational variables. Other techniques were considered. Cluster analysis, used in many of the studies reviewed in this report, was viewed as a technique which is very similar to factor analysis, but with a little bit less statistical elegance. Numerical taxonomy, a technique developed and used frequently for biological and zoological taxonomies, was also considered. One of the kinds of input often used in numerical taxonomy programs is data from factor matrices and correlation matrices. With a view toward additional analysis, if needed, it was decided that factor analysis would be selected. Should this analysis not have provided well defined and meaningful factors, it would have been possible to subject a smaller matrix as derived from the factor analysis (approximately 40 x 40) to the numerical taxonomy program.

Finally, the nature of the data itself seemed to lead in the direction of factor analysis. We conceptualized the ratings as an interval measure of evaluation rather than a nonmetric yes/no type response. Factor analysis is more appropriate for this kind of data while nonmetric cluster analysis techniques would be more appropriate for a nominal scaling.

INVESTIGATION OF INTER-RATER RELIABILITY

During the course of the taxonomic development 239 articles were evaluated using the method previously described. Six in-house raters were employed for this purpose. Since it was perceived to be extremely time consuming and therefore of questionable cost effectiveness for all raters to rate all articles, it was determined that each article would be evaluated by a single rater. Articles were classified into the five generic categories as follows:

1. Organizational psychology and behavior
2. General systems theory
3. Organizational effectiveness and development
4. Simulation
5. Training

These classifications were defined arbitrarily, and a great deal of overlap occurred between the classification categories. Each of the six raters generally rated articles in a single category, however, overlap across categories also occurred in the selection of articles by raters.

It was necessary to estimate the extent to which the reliability of assigning general systems theoretic terms and/or organizational attributes to articles was consistent across the six raters. For this purpose a pilot inter-rater reliability study was conducted.

Five articles were selected at random; one from each of the five categories previously listed. These articles were:

1. Georgopoulos and Tannenbaum (1957) -- Organizational Effectiveness
2. Lucas (1979) -- Simulation
3. Kast and Rosenzweig (1972) -- General Systems Theory
4. O'Reilly and Roberts (1974) -- Organizational Psychology
5. DeCotiis and Morano (1977) -- Training

Five inter-rater reliability coefficients were then computed following techniques described in Winer (1971, pp. 283-289). This method of computing inter-rater reliability involves use of an Analysis of Variance model to estimate reliability of measurement of the taxonomic category assignments by the raters. Five ANOVA's were computed, one for each article across the ratings assigned by the six raters. (All raters rated all five articles.)

Tables 13 through 17 show the Analysis of Variance results and the resulting inter-rater reliability coefficients for the five articles. As can be seen inter-rater reliability was moderate across the six judges, ranging from a low of .45 to a high of .70. Such a level of reliability indicates some consistency across judges in their assessment of the extent to which the same general systems theoretic terms and/or organizational attributes were included in each of the five randomly selected sample articles on which the pilot study was conducted.

Table 13

ANOVA Results for Article 1

Article 1 - Georgopoulas & Tannenbaum (1957)			
Source	SS	df	MS
Between Categories	251.765	84	2.99
Within Categories	168.5	425	.396
Between Judges	32.76	5	6.552
Residual	135.73	420	.323
Total	420.265	509	
r_6 = .868	r_1 = .523 (Spearman-Brown adjusted)		

Table 14

ANOVA Results for Article 2

Article 2 - Lucas (1979)			
Source	SS	df	MS
Between Categories	127.26	84	1.515
Within Categories	64.67	425	.152
Between Judges	3.15	5	.63
Residual	61.52	420	.146
Total	191.93	509	
r_6 = .900	r_1 = .600 (Spearman-Brown adjusted)		

Table 15

ANOVA Results for Article 3

Article 3 - Kast & Rosenweig (1972)			
Source	SS	df	MS
Between Categories	226.875	84	2.70
Within Categories	139.5	425	.328
Between Judges	9.76	5	1.952
Residual	129.74	420	.3089
Total	366.37	509	
r_6 = .878	r_1 = .546 (Spearman-Brown adjusted)		

Table 16

ANOVA Results for Article 4

Article 4 - O'Reilly & Roberts (1974)			
Source	SS	df	MS
Between Categories	212.48	84	2.53
Within Categories	71.34	425	.168
Between Judges	2.796	5	.56
Residual	68.544	420	.16
Total	283.82	509	
r_6 = .934	r_1 = .701 (Spearman-Brown adjusted)		

Table 17

ANOVA Results for Article 5

Article 5 - DeCotiis & Morano (1977)			
Source	SS	df	MS
Between Categories	158.555	84	1.8875
Within Categories	135.00	425	
Between Judges	45.71	5	9.142
Residual	89.29	420	.2126
Total	283.55	509	
r_6 = .832	r_1 = .452 (Spearman-Brown adjusted)		

THE PILOT FACTOR ANALYSIS

A pilot factor analysis was conducted using the checklist evaluations for the initial 239 articles. The BMDP-79(1979) P4M factor analysis program was used for the analysis of the data. A principal components method was used for the initial factor extraction followed by an orthogonal rotation to simple structure with the varimax criterion. For this analysis the raw data from the checklist were changed from the 0,1,2,3 coding scheme to a 1,2,3,4 code. The factor analysis was performed on the correlation matrix derived for the raw data. A 30-factor extraction was specified for this program in addition to the preassigned criterion for the number of factors being those factors with eigenvalues greater than unity.

Although this termination point is an arbitrary decision it seems that meaningfulness rather than mathematical elegance should be the fundamental concern. Support for this criterion is found in Harman's (1967) citation of Kaiser's recommendation that "after considering statistical significance, algebraically necessary conditions, psychometric reliability, and psychological meaningfulness--.... the number of common factors should be equal to the number of eigenvalues greater than one ..." (p. 198). Rummel (1970) suggests that the generalizability of a factor decreases as the eigenvalue falls below unity and the variance accounted for is small in comparision to other factors in the matrix (pp. 354-364).

The results of the pilot factor analysis are presented in Table 18. The criterion used for selecting variables for each factor was a factor loading of .40 or greater on one factor and no loadings greater than .30 under any other factor. The results depicted in Table 18 show only those variables which were sorted by the rotated factor matrix in accordance with the .40/.30 criterion. One of the lessons learned from this pilot run was that the amount of work space designated in the control cards for the computer run was not sufficient to reach the 30 factor criterion specified for the run. Hence, the factor extraction terminated after 17 factors. However, it is instructive to note from Table 18 that the eigenvalues begin to drop off between Factor VII and Factor VIII and levels after Factor VIII. Figure 7 depicts this factor variance leveling. This

Table 18

Sorted Factor/Variable Matrix

Factor	I	II	III	IV	V
	Loading/Variable				
	.79 Integration	.71 Power	.72 Certainty	.76 Closed System	.64 Job/Task Analysis
	.74 Complexity	.65 Influence	.72 Change	.69 Open System	.60 Job
	.74 Differentiation	.47 Authority	.65 Decentralization	.69 Equifinality	.52 Task
	.66 Information		.52 Size	.49 Subsystem	
	.60 Decision Making				
	.57 Input				
	.57 Sensing				
	.55 Simplicity				
	.55 Environment				
Eigenvalue[a]	6.044	2.905	2.796	2.730	2.695
Cumulative % Factor Variance[b]	14.2%	19.1%	25.7%	32.1%	38.4%

[a] Of principal components, not of rotated factors.

[b] Based on 17 factors extracted

Table 18 (Continued)

Sorted Factor/Variable Matrix

Factor	VI	VII	VIII	IX	X
	Loading/Variable				
	.64 Communications	.71 Training	.67 Goal Attainment	.46 Input	.75 Growth
	.62 Communications Barriers	.63 Management		.58 Process	.75 Consensus
	.55 Direction	.54 Effectiveness		.55 Output	.45 Values
Eigenvalue[a]	2.614	2.592	2.192	2.177	2.167
Cumulative % Factor Variance[b]	44.6%	50.7%	55.8%	60.9%	66.0%

[a] Of principal components, not of rotated factors

[b] Based on 17 factors extracted

Table 18 (Continued)

Sorted Factor/Variable Matrix

Factor	XI	XII	XIII	XIV	XV
	Loading/Variable				
	.70 Absenteeism	.65 Development	.69 Optimization	.59 Role	.62 Responsibility
	.68 Incentive	.63 Organization	.51 Suboptimization	.45 Interdependence	.51 Maturity
	.54 Intervention	.54 Disorganization	.47 Adaptability	.48 Conflict	
				.45 Conflict Reg.	
Eigenvalue[a]	2.141	2.140	2.137	2.053	2.019
Cumulative % Factor Variance[b]	71.0%	76.1%	81.1%	85.9%	90.6%

[a] Of principal components, not of rotated factors

[b] Based on 17 factors extracted

Table 18 (Continued)

Sorted Factor/Variable Matrix

Factor	XVI	XVII
	Loading/Variable	
	.66 Goals	.69 Rigidity
	.61 Goal Succession	.63 Change
	.43 Goal Setting	.60 Change Agent
		.44 Standards
Eigenvalue[a]	2.007	1.97[illegible]
Cumulative % Factor Variance[b]	95.4%	100%

[a] Of principal components, not of rotated factors

[b] Based on 17 factors extracted

suggested that a more meaningful factor structure might be obtained by running, successively, analyses with factor numbers specified at 9, 8, 7, 6, and 5. This kind of analysis would illustrate where variables moved and/or clustered in each successive run. This analysis would also tend to show some factor relationships at a very gross level of interpretation.

For the pilot run of the factor analysis no attempt was made to name the factors. In the section that follows the results of the final factor analysis are presented.

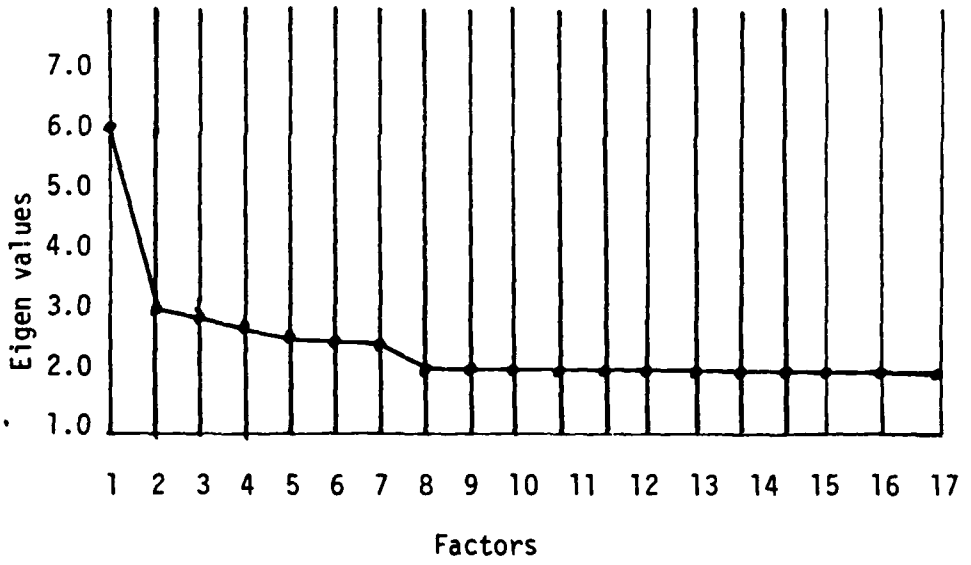


Figure 7. Factor Variance Leveling

SECTION 3.0 RESULTS AND DISCUSSION

RESULTS

A final factor analysis was conducted using a randomly selected sample of 210 articles. Based on the results of the pilot study, factor extractions were specified at 9, 8, 7, 6, and 5 factors. Table 19 lists the variable loadings under each factor for each of the designated runs. Only those variables with loadings of .40 or higher were listed under their respective factors. Based on a review of the factor structure through each of the designated rotations it was determined by the project team that the six factor solution appeared to be most meaningful for purposes of this study. A review of Table 19 indicates overall factor stability and reliability as shown by the vertical arrows, from one rotation to the next. With minor exceptions at the 9 factor solution and the 6 factor solution, the order of the factor structure remained constant. The factor structure in this run is also very similar to that obtained in the pilot run.

Table 20 depicts the variable loading matrix for the six factor solution along with the eigenvalues and the cumulative percent of factor variance accounted for by each factor.

An analysis of the variables loading under each factor in the solution lead to the following conclusions regarding major taxonomic categories:

Table 19.

Sorted Factor Variable Matrix

Factor Loading/Variable	I	II	III	IV	V	VI	VII	VIII	IX
	.69 Integration	.61 Equilibrium	.67 Change	.74 Centralization	.62 Conflict Regula.	.62 Goal Attainment		.54 Channel	.61 Certainty
	.67 Input	.58 Open System	.48 Feedback	.64 Size	.57 Conflict	.57 Goal Succession		.52 Comm. Barriers	.51 Initiative
	.67 Complexity	.47 Closed System	.49 Intervention	.62 Decentralization	.41 Consensus	.57 Goal Setting		.44 Communications	.42 Disorganization
	.62 Output	.46 Growth	.40 Management	.56 Independence	.41 Role	.55 Goals			.50 Suboptimization
	.62 Information	.47 Subsystem	.44 Training			.48 Goal Displacement			
	.59 Sensing		.42 Effectiveness						
	.59 Differentiation								
	.56 Decision Making								
	.53 Environment								
	.70 Integration	.59 Equilibrium	.66 Change Agent	.52 Power	.67 Independence	.59 Goal Attainment	.45 Initiative	.55 Channel	
	.68 Input	.55 Open System	.51 Feedback	.52 Influence	.65 Centralization	.59 Goal Setting		.44 Communications	
	.67 Complexity	.46 Closed System	.48 Interaction	.43 Incentive	.64 Size	.55 Goals		.44 Group Dynamics	
	.62 Output	.42 Growth	.45 Job Enrichment		.55 Decentralization	.54 Goal Succession			
	.61 Information		.48 Organization						
	.59 Differentiation		.44 Training						
	.59 Sensing		.41 Effectiveness						
	.56 Decision Making								
	.54 Environment								
	.69 Integration	.58 Subsystem	.64 Change Agent	.60 Influence	.66 Independence	.58 Goal Setting	.42 Consensus		
	.69 Input	.54 Direction	.48 Intervention	.50 Power	.66 Centralization	.57 Goal Attainment	.41 Optimization		
	.66 Complexity	.46 Adaptability	.47 Job Enrichment	.40 Responsibility	.65 Size	.56 Goals	.40 Resource Allocation		
	.65 Information	.42 Maturity	.44 Organization	.48 Hierarchy	.54 Decentralization	.53 Goal Succession			
	.62 Output	.44 Open System	.42 Process		.49 Interdependence	.46 Goal Displacement			
	.58 Differentiation	.46 Rigidity	.42 Training						
	.58 Sensing	.42 Certainty							
	.56 Decision Making								
	.52 Environment								
	.71 Input	.55 Subsystem	.66 Change Agent	.57 Influence	.67 Independence	.61 Goal Setting			
	.69 Integration	.54 Equilibrium	.53 Feedback	.52 Power	.64 Centralization	.56 Goals			
	.66 Complexity	.51 Open System	.49 Intervention	.42 Conflict	.64 Size	.52 Goal Succession			
	.65 Output	.49 Direction	.47 Job Enrichment	.48 Hierarchy*	.55 Decentralization	.52 Goal Attainment			
	.62 Information	.44 Growth	.45 Organization	.41 Interaction	.51 Interdependence	.44 Goal Displacement			
	.58 Differentiation	.47 Adaptability	.42 Process	.47 Authority*	.45 Authority*				
	.56 Sensing	.46 Closed System	.41 Training	.41 Role					
	.55 Decision Making	.42 Rigidity							
	.54 Environment								
	71 Integration	.58 Authority*	.56 Equilibrium	.42 Authority*	.53 Absenteeism				
	.70 Input	.57 Change Agent	.55 Subsystem	.63 Centralization	.51 Goal Setting				
	.66 Complexity	.52 Power	.52 Open System	.63 Independence	.48 Goals				
	.63 Output	.45 Job Enrichment	.47 Direction	.59 Size	.46 Goal Attainment				
	.61 Information	.45 Management	.42 Growth	.57 Decentralization	.46 Goal Succession				
	.58 Differentiation	.44 Competence	.45 Adaptability*	.42 Hierarchy	.46 Turnover				
	.57 Decision Making	.46 Responsibility	.46 Closed System	.48 Interdependence					
	.56 Sensing	.50 Role							
	.54 Environment								

* These variables were not unidimensional. They are included in the matrix to illustrate relationships among factors and variables; i.e., the .40/.30 criteria was not met by these variables indicating a factorially complex variable. It should be emphasized that the number of factorially complex variables is very small considering the size of the variable matrix and the complexity of the taxonomic research problem.

Table 20. Six Factor Solution/Variable Loading Matrix

	Factor					
	I	II	III	IV	V	VI
Variables	.71 Input	.55 Subsystem	.66 Change Agent	.57 Influence	.67 Independence	.61 Goal Setting
	.69 Integration	.54 Equilibrium	.53 Feedback	.52 Power	.61 Centralization	.56 Goals
	.66 Complexity	.51 Open System	.49 Intervention	.42 Conflict	.64 Size	.52 Goal Succession
	.65 Output	.49 Direction	.47 Job Enrich-ment/En-largement	.48 Hierarchy*	.55 Decentralization	.52 Goal Attainment
	.62 Information	.44 Growth		.41 Interaction	.51 Interdependence	.44 Goal Displace-ment
	.58 Differentiation	.47 Adaptability	.45 Organization	.57 Authority*	.45 Authority*	
	.56 Sensing	.46 Closed System	.42 Process	.41 Role		
	.55 Decision Making	.42 Rigidity	.41 Training			
	.54 Environment					
Eigenvalue[a]	5.193	3.867	3.662	3.503	3.366	3.108
Cumulative[b] Factor Variance	22.88%	39.91%	56.04%	71.48%	86.31%	100.00%

- Factor I was termed Multidimensional Information Processing and accounted for 22.88% of the factor variance. The variables which load on this factor reflect both a process systems model of organizations and/or the individual/group/organization processes associated with acquiring information, processing information, and disseminating that information (including decision making) as components in complex multidimensional environments. They also address the structure of how information is processed in organizations.

- Factor II was called Organizational Systems Dynamics and accounted for 17.0% of the factor variance. The variables which load on this factor represent the characteristics of an organizational system relative to its adaptation and flexibility as it copes with its environment, attempts to maintain a relatively steady state or balance, and utilizes its resources to grow in more, or less planned ways.

- Factor III was called Organizational Change Technologies and accounted for 16.13% of the factor variance. The variables loading on this factor focus on those techniques normally associated with the organizational development/organizational effectiveness domain and reflect concerns for individual growth and development in organizations, personnel interface with jobs, the organization, and the work process. This factor identifies human resource technologies associated with enhancing individuals and work group perceptions regarding job development and/or modification.

- Factor IV was called Management Authority/Compliance Characteristics and accounted for 15.44% of the factor variance. The variables loading on this factor are associated with the dimensions of influence and power as components in the superior/subordinate organizational scheme where compliance is required, for example, from subordinates relative to their position or level in the scaler chain. The variables reflect status or hierarchical leveling attributes found in most organizations normally associated with management control procedures.

- Factor V was called Organizational Coordination and Control and accounted for 14.83% of the factor variance. The variables which loaded on this factor reflect characteristics of organizations associated with structure and those concerns leading to the coordination and/or control of the organizational systems, subsystems and subsidiaries.

Because of the "authority" variable loading on this dimension as well as under Factor IV one might speculate that a relationship exists between the two factors. The Management Authority factor (Factor IV) may well describe the individual control dimension in organizations, i.e., the manager influencing and controlling his subordinates, while the Organizational Coordinator and Control factor (Factor V) may describe those structural/organizational features related to coordination and control at the organizationwide level.

- Factor VI was called Goal Orientation and accounted for 13.69% of the factor variance. Variables loading under this factor reflect those activities that organizations and individuals engage in to determine desired states that the organizational system and its personnel are attempting to achieve through planning, organizing, and controlling. Most organizations, by definition, are goal directed and the variables loaded under this factor focus on the range of goal activities required by an organizational system to determine priorities, to achieve objectives, and to modify or replace those objectives no longer important to the system.

DISCUSSION

Factor analysis identified six distinct and relatively stable factors related to organizational systems. With minor exceptions the composition of each factor, i.e., the variables loaded under each factor remained consistent over several specifically designated runs. This consistency may lead one to the conclusion that there is little relationship between factors. However, the appearance of unrelated factors and/or variables is partly due to an artifact of the rotation procedures specified for this program, i.e., an orthogonal rotation.

The first factor, multidimensional information processing, was the most reliable and consistent factor of all. This factor appears in both the pilot run and the final run and had only

minor changes in factorial composition among the different runs. This finding suggests a degree of consistency and concern among the articles selected for review regarding this factor in organizational theory. What the factor analytic procedure tells us is that there is concurrence among a wide sample of organizational specialists regarding the affinity or clustering among the variables loading under the first factor. The analysis shows how these variables hang together in defining this factor. Factor 1 reflects organizational (as well as individual) multi-dimensional processes where the dimensionality of inputs or information is sensed, is differentiated and integrated through the structure of the organization. Multidimensionality (complexity) of decision making and organizational output is achieved via the same integrative and differentiative processes. Factor 1 is a process factor in the best tradition of system theoretic conceptualization, applicable to a number of levels and a number of entities (e.g., persons and their information processing, organizations and their processing, structure of the organizations themselves, etc.).

One of the major objectives of this project was to place the research variables in a systems theoretic framework. Since the original list of organizational terms included a sizable number of "marker variables" relative to systems theory, it is not surprising that an organizational system dynamics factor appeared in the factor solution. This factor also exhibited relative stability and consistence in terms of its factorial composition. However, a change from it being Factor II to Factor III was noted between the six and five factor solution. The interesting result relative to this dimension was the composition of the factor itself, i.e., the variables loading under

this factor. There appears to be a definitive description in this factor which combines some organizational theory constructs with general systems theory concepts. The composition of this factor suggests the all important dimension of organizations which makes them able to flow with the ebb and tide of environmental fluctuations. Further, the factor denotes a planned growth characteristic which reflects an organization's logic and use of system components to maintain dynamic homeostasis.

Another major objective of this project included a concern for the methods and/or techniques associated with the organizational effectiveness (OE) domain. The third factor, organizational change technologies, is an outcome of this frame of reference. The composition of Factor III also shows some relationship to the systems theoretic framework in its inclusion of the "organization" and "process" variables. Change technologies are thus viewed as ongoing, dynamic, "in-process" activities. This factor remained stable through the 6 factor solution where it then reversed position with the organizational system dynamic factor. One might postulate an interaction between these two factors based on this reversal in the factor pattern.

The fourth and fifth factors, management authority/compliance characteristics and organizational coordination and control, seemed to reflect some of the very traditional organizational variables found in much of the literature serving as input data to the factor analysis. There was some factor pattern reversal starting with the 9 factor solution but the composition of the two factors remained relatively consistent over all the runs.

It is instructive to note here that the rationale for selecting the 6 factor solution resided in the breakdown of factor composition in the 5 factor solution for Factor IV and Factor V. It is at this point that variables loading under each respective factor seem to intermingle and make the factors nearly uninterpretable. One could speculate that the communality of loadings for "authority" in both IV and V may have contributed to the decomposition of these factors in the final solution. On the other hand it could be argued that the "authority" variable binds the two factors together and, in the first case we have the individual management dimension, while, in the second case, we have the systemwide control or structural dimension. In either case there seems to be some relationship between these two factors.

The final factor, goal orientation shows one of the most reliable factors in the entire solution. All of the variables which loaded under this dimension hung together consistently from one solution to the next. This may have been a result of the way that articles tend to treat this factor, i.e., it is not surprising to find discussions in the literature which cluster goal concepts in the fashion found in the factor solution. The composition of this factor seems well defined, highly relevant to its name, and directly related to a major dimension of both systems theory and organizational theory, goal direction.

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APPENDIX A

List of Organizational Behavior/Systems Theory Terms

1. Absenteeism - temporary loss of personnel resources, and thus matter, energy, and information, from the system.
2. Adaptability - ability of a system to react or respond to changes in the environment; includes adaptation, coping, flexibility.
3. Authority - inter-party exchange relationship in which legitimated power (i.e., that which coincides with values of involved parties) is exerted.
4. Boundary - conceptual or physical line or area which determines inclusion in or exclusion from a system.
5. Capability - inherent ability, by virtue of self-contained attributes and resources, of a system to perform; includes capacity, potential.
6. Centralization - dominance of an element (the leading part), and thus concentration of authority and/or resources, in the operation of a system.
7. Certainty - absence of ambiguity in, and thus full appreciation of, the environment; complete knowledge.
8. Change - alteration, or modification, from one condition or state to another; includes innovation (implementation of change).
9. Change Agent - a party or an element that induces or brings about change.
10. Channel - pathway or avenue for the flow of matter, energy, and/or information; includes network.
11. Climate - environmental dimension(s) that materially affect(s) a system's functioning; includes organizational health/pathology/personality.
12. Closed System - a system that has no environment or is isolated from its environment.
13. Communications - transmission of information between two or more parts of a system; includes bargaining, information exchange.
14. Communication Barriers - factors or conditions that impede or distort the "natural" flow of information.
15. Competence - ability of a system/subsystem to perform as intended.
16. Complexity - combination of a large number of elements that interact in a non-simple manner; includes dimensionality.
17. Conflict - mutual opposition between competing, contradictory, or inconsistent impulses, tendencies, or values; includes confrontation, competition.
18. Conflict Regulation - adjustment or manipulation of a conflict situation in conformance with some established objective(s).
19. Consensus - congruence of opinion; includes agreement.

20. Control - regulation of actions, behaviors, and conditions in conformance with established objectives and standards; includes compliance, conformity, correction, maintenance.

21. Creativity - generation of new patterns of performance, alternatives, etc.

22. Decentralization - diffusion of authority and/or resources to a system's elements; absence of a dominant element (or leading part).

23. Decision-Making - the process and action of choosing among alternatives; includes choice, problem-solving.

24. Development - progressive advancement or emergence to new and appropriate states or conditions; includes dynamic equilibrium, evolution, heterostasis, morphogenesis.

25. Differentiation - distinctiveness or distinguishability of a system's components; includes compartmentation, division of labor, elaboration, specialization.

26. Direction - the act of providing or establishing instructions, orders, or guidance; includes intentionality.

27. Disorganization - absence of coherence or order in the environment; includes disorder, entropy.

28. Effectiveness - accomplishment of prescribed goals and objectives.

29. Efficiency - a measure of the volume of output for a given level of input.

30. Environment - those elements or objects not part of a system, but changes in which affect and are affected by the system; includes situation.

31. Equifinality - the concept which recognizes that the same final state may be reached from different initial conditions and in different ways.

32. Equilibrium - the tendency of a system to return to a given point or state after being disturbed by external forces; includes balance, homeostasis, morphostasis, stability, steady state.

33. Feedback - outputs or behaviors of a system which become informational inputs for subsequent system adjustments.

34. Goal(s) - a desired end-state or intermediate end-state toward which a system directs its activities or is oriented; includes objectives, requirements.

35. Goal Attainment - a condition of reaching an established goal; includes performance, productivity.

36. Goal Displacement - substitution of a goal for which a system was not created for a legitimate, prescribed goal.

37. Goal Setting - the act of establishing goals; includes expectations/expectancy.

38. Goal Succession - replacement of a prescribed goal by an improved goal; includes ideal-seeking.

39. Group Dynamics - the interactive exchange process among the elements of a particular collective that is united by some purpose.

40. Growth - expansion of the number of elements constituting a set.

41. Hierarchy - arrangement of the components of a system in a higher-lower, or superordinate-subordinate, relationship.

42. Incentive - a stimulus or impetus for some action or behavior; includes reinforcement, reward.

43. Independence - a condition of unrelatedness among a set of parts or elements; includes autonomy, totipotentiality.

44. Influence - inter-party exchange process in which one party has the ability to affect, or induce behaviors in, the other.

45. Information - the degree of freedom that exists in a given situation to choose among signals, symbols, messages, or patterns to be transmitted; includes experience, knowledge, learning, variety.

46. Initiative - self-generated or self-originated action requiring no direct stimulus; includes proaction.

47. Input - matter, energy, and/or information introduced into a system; includes contribution, resources.

48. Integration - mechanisms and principles which hold a system together; the unity of the elements comprising that system; includes symbiosis.

49. Interaction - mutually effective action involving two or more systems of the same or of different orders; includes cooperation, coordination, human relations, participation.

50. Interdependence - a condition in which every part of the system is so related to every other part that a change in one affects all others as well as the total system; includes partipotentiality.

51. Intervention - insertion of a third-party into an existing relationship among elements.

52. Job - a function that must be performed for the accomplishment of a particular system/subsystem activity.

53. Job Enrichment/Enlargement - expansion or diversification of the elements comprising a job.

54. Job/Task Analysis - investigation of the characteristics and components of a job or a task.

55. Leadership - an inter-party exchange relationship represented by an influential increment over and above mechanical compliance with routine directions.

56. Management - a process by which the elements of a system are integrated, coordinated, and/or utilized so as to achieve established goals and objectives.

57. Maturity - a level of development reflecting chronological and competency dimensions; includes organizational life.

58. Open System - a system which exchanges energy, matter, and/or information with its environment; includes permeability.

59. Optimization - the act of seeking a "best" state under a given set of environmental conditions or constraints.

60. Organization - a condition of order or coherence; includes cohesion, negative entropy.

61. Output- energy, matter, and/or information produced by a system; includes product.

62. Performance Evaluation/Appraisal - assessment of a system's performance against established objectives and standards.

63. Plan/Planning - a design for the attainment of some goal or objective; includes strategy/strategize.

64. Power - an inter-party exchange relationship in which one party has the ability to induce acceptance of direction by another; includes coercion, dominance.

65. Process - the intra-system transformation activities by which inputs are converted into outputs; includes implementation, throughput.

66. Resource Allocation - distribution of available resources to components of the system.

67. Response - reaction to a particular stimulus or influence.

68. Reponsibility - formal accountability for system performance.

69. Rigidity - inability to cope with environmental demands; includes resistance to change.

70. Role - a function (formal or informal) assumed by an element of the system; includes relationship.

71. Sensing - acquisition by a receptor of environmental stimuli; includes cognition, forecasting, scanning.

72. Simplicity - delimitation or restriction of the number of elements in the environment that must be dealt with by a system; includes routinization.

73. Size - measure, extent, or range of an element or activity.

74. Standards - prescribed levels of performance or achievement necessary for the attainment of established goals and objectives; includes critical variables, norms, regulations, rules.

75. Structure - the arrangement or configuration of a set of interrelated parts; includes design, form, formalization.

76. Suboptimization - the act of seeking a less-than-optimum, or "non-best", state; includes equity, incrementalism, satisficing.

77. Subsystem - an element or functional component of a larger system; includes group, team.

78. Synergism - a process that produces an output or result that is greater in its totality than the sum of its individual parts; includes Gestalt, holism, organicism.

79. Task - a specific undertaking or duty that contributes to the performance of a job.

80. Technology - knowledge and means for the production of things (symbols or materials); includes automation.

81. Training - preparatory instruction or drill necessary to produce desired skills, proficiency, qualifications, or capabilities.

82. Turnover - permanent loss of personnel resources, and thus matter, energy, and information, from the system.

83. Uncertainty - ambiguity in, and lack of complete knowledge about, the environment.

84. Values - intrinsic desirability, utility, or worth.